MULTI-INNO TECHNOLOGY CO., LTD.

LCD MODULE SPECIFICATION

Model : MI0347AT-2

Revision	1.0
Engineering	
Date	
Our Reference	

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REVISION RECORD

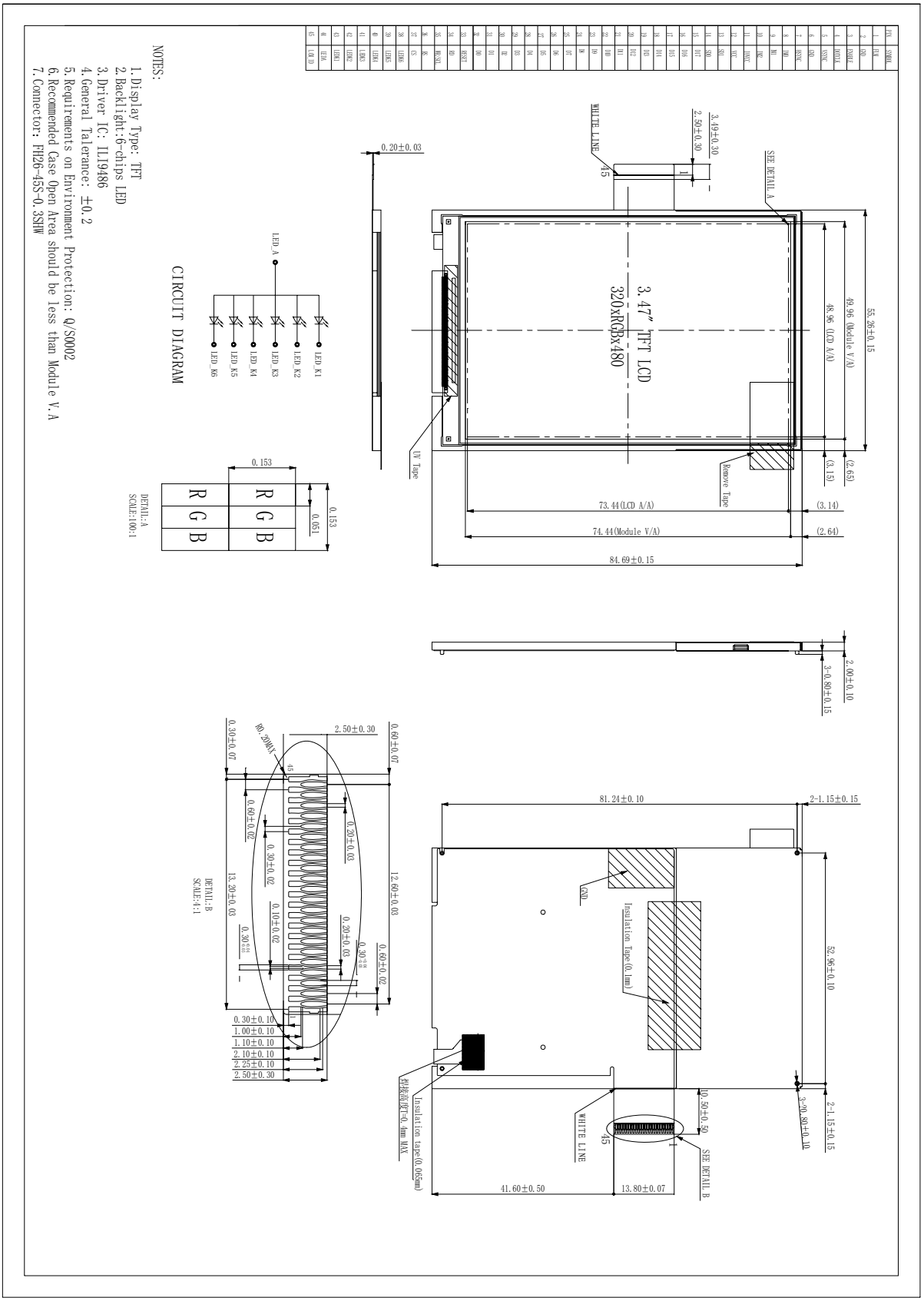
REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2011-05-20	Preliminary Specification Release	/

CONTENTS

■ GENERAL INFORMATION

Item of general information	Contents	Unit
LCD type	TFT/TRANSMISSIVE/NORMALLY BLACK	/
Size	3.47	Inch
Recommended Viewing Direction	--	O' Clock
Module area (W × H ×T)	55.26×84.69×2.00	mm^3
Active area (W×H)	48.96×73.44	mm^2
Number of Dots	320RGB×480	/
Pixel pitch (W × H)	0.153×0.153	mm^2
Driver IC	ILI9486	/
Interface Type	CPU/RGB	/
Input voltage	2.8	V
Module Power consumption	--	mw
Colors	65K/262K	/
Backlight Type	6LED	/

■ EXTERNAL DIMENSIONS



■ ABSOLUTE MAXIMUM RATINGS

Parameter of absolute maximum ratings	Symbol	Min	Max	Unit
Logic supply voltage	IOVCC	-0.3	4.6	V
Analog supply voltage	VCC	-0.3	4.6	V
Input voltage	VIN	-0.3	IOVCC+0.3	V
Operating temperature	Top	-20	70	°C
Storage temperature	TST	-30	80	°C
Backlight forward current	I_{LED}	-	25	mA
Humidity	RH	-	90%(Max60 °C)	RH

Note 1: VIN: /CS,/RD,/WR(SCL),RS,ENABLE,VSYNC,HSYNC, DOTCLK,SDI,/RESET,IM0,IM1,IM2,DB[0~17]

■ ELECTRICAL CHARACTERISTICS

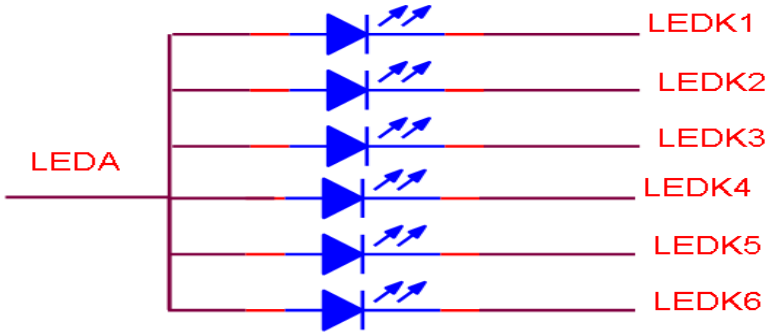
DC CHARACTERISTICS

Parameter of DC characteristics	Symbol	Min	Typ	Max	Unit
Supply voltage for logic	VCI	2.5	2.8	3.3	V
I/O power supply	IOVCC	1.65	2.8	3.3	V
Input voltage 'H' level	VIH	0.7IOVCC	-	IOVCC	V
Input voltage 'L' level	VIL	0	-	0.3IOVCC	V
Output voltage 'H' level	VOH	0.8IOVCC	-	IOVCC	V
Output voltage 'L' level	VOL	0	-	0.2IOVCC	V

■ BACKLIGHT CHARACTERISTICS

Item of backlight characteristics	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage	Vf	-	3.2	-	V	If=20mA Ta=25℃
Backlight power consumption	W_{BL}	-	384	-	mW	For 6 LEDs
Number of LED	-	-	6	-	Piece	-
Operating Life Time	-	10000	20000	-	Hrs	For each LED

Note 1: The figure below shows the connection of backlight LED.



Note 2: One LED :1/6x I_F =20mA, V_F =3.2V

Note 3: : I_F is defined for one channel LED.

Optical performance should be evaluated at Ta=25℃ only.

If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

■ ELECTRO-OPTICAL CHARACTERISTICS

Item of electro-optical characteristics	Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time	Tr+ Tf	θ=0° ∅=0° Ta=25℃	-	70	90	ms	Fig.1	4
Contrast ratio	Cr		400	800	-	---	FIG 2.	1
Luminance uniformity	δ WHITE		75	80	-	%	FIG 2.	3
Surface Luminance	Lv		280	350	-	cd/m^2	FIG 2.	2
Viewing angle range	θ	∅ = 90°	70	80	-	deg	FIG 3.	6
		∅ = 270°	70	80	-	deg	FIG 3.	
		∅ = 0°	70	80	-	deg	FIG 3.	
		∅ = 180°	70	80	-	deg	FIG 3.	
NTSC ratio	---	---	55	60	---	%	-	-
CIE (x, y) chromaticity	Red x	θ=0° ∅=0° Ta=25℃	0.570	0.620	0.670	-	FIG 2.	5
	Red y		0.293	0.343	0.393	-		
	Green x		0.280	0.330	0.380	-		
	Green y		0.558	0.608	0.658	-		
	Blue x		0.103	0.153	0.203	-		
	Blue y		0.019	0.069	0.119	-		
	White x		0.265	0.315	0.365	-		
	White y		0.293	0.343	0.393	-		

Note1. Contrast Ratio(CR) is defined mathematically by the following formula. For more information see FIG 2.:

$$\text{ContrastRatio} = \frac{\text{AverageSurface Luminance with all white pixels (P 1, P2, P 3, P4, P5)}}{\text{Average SurfaceLuminance with all black pixels (P1, P2, P 3, P4, P5)}}$$

Note2. 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)

Note3. 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.

$$\delta \text{ WHITE} = \frac{\textbf{Minimum Surface Luminance with all white pixels } (\mathbf{P_1, P_2, P_3, P_4, P_5})}{\textbf{Maximum Surface Luminance with allwhite pixels } (\mathbf{P_1, P_2, P_3, P_4, P_5})}$$

Note4. 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..

Note5. CIE (x, y) chromaticity ,The x,y value is determined by screen active area position 5. For more information see FIG 2.

Note6. 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.

Note7. 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 and CIE， the testing data is base on TOPCON's BM-5 photo detector.

Note8. For TFT transmissive module,Gray scale reverse occurs in the direction of panel viewing angle

FIG.1. The definition of Response Time

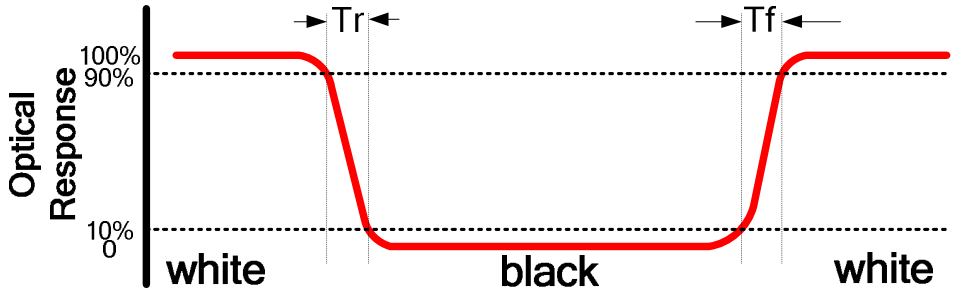


FIG.2. Measuring method for Contrast ratio,surface luminance, Luminance uniformity,CIE (x, y) chromaticity

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

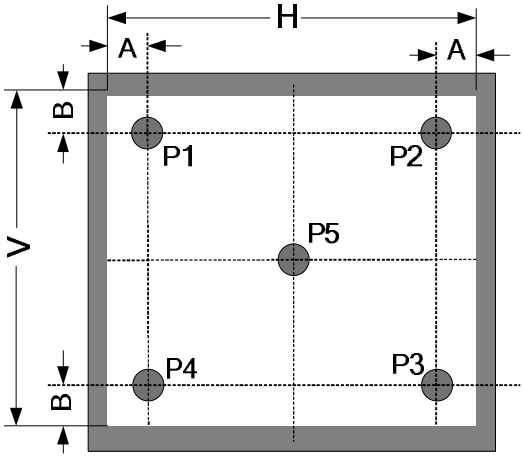
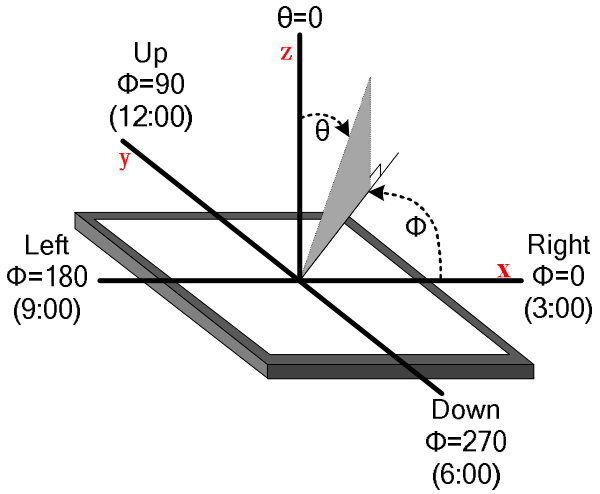


FIG.3. The definition of viewing angle



■ INTERFACE DESCRIPTION

No	Symbol	I/O	Description	Comment
1	FLM	O	Tearing signal output. If not used, please open this pin.	
2	GND	P	Ground	
3	ENABLE	I	Data enable signal in RGB mode. If not used, please fix this pin to GND.	
4	DOTCLK	I	Pixel clock signal in RGB mode. If not used, please connect this pin to GND.	
5	VSYNC	I	Vertical synchronous signal in RGB mode. If not used, please connect this pin to GND.	
6	GND	P	Ground	
7	HSYNC	I	Horizontal synchronous signal in RGB mode. If not used, please connect this pin to GND.	
8	IM0	I	System interface mode select	Note(3)
9	IM1	I		
10	IM2	I		
11	IOVCC	P	Digital power	
12	VCC	P	Analog power	
13	SDI	I/O	Serial data in/out pin in DBI Type C 9bit mode. Serial data input pin in DBI Type B 8bit mode If not used, please connect this pin to GND.	
14	SDO	O	Serial data output pin. If not used, please connect this pin to GND.	
15	DB17	I/O	Data input/output	
16	DB16	I/O	Data input/output	
17	DB15	I/O	Data input/output	
18	DB14	I/O	Data input/output	
19	DB13	I/O	Data input/output	
20	DB12	I/O	Data input/output	
21	DB11	I/O	Data input/output	
22	DB10	I/O	Data input/output	
23	DB9	I/O	Data input/output	
24	DB8	I/O	Data input/output	
25	DB7	I/O	Data input/output	
26	DB6	I/O	Data input/output	
27	DB5	I/O	Data input/output	
28	DB4	I/O	Data input/output	
29	DB3	I/O	Data input/output	
30	DB2	I/O	Data input/output	
31	DB1	I/O	Data input/output	
32	DB0	I/O	Data input/output	
33	/RESET	I	Reset signal	

34	RD	I	Read strobe signal If not used, please connect this pin to IOVCC	
35	/WR/SCL	I	(WR) Write data enable pin in DBI Type B; (SCL) Write data enable pin in DBI Type C; If not used, please connect this pin to IOVCC	
36	RS	I	Data/command selection pin. RS=1,select data; RS=0,select command. If not used, please connect this pin to GND.	
37	/CS	I	Chip select signal, signal is ″low″ enable	
38	LEDK6	P	LED cathode	
39	LEDK5	P	LED cathode	
40	LEDK4	P	LED cathode	
41	LEDK3	P	LED cathode	
42	LEDK2	P	LED cathode	
43	LEDK1	P	LED cathode	
44	LEDA	P	LED anode	
45	LCM_ID	O	Customer Identification Pin，connected to IOVCC	

Note

(1) I/O definition:

I/O-----Input/Output, I-------Input, P------Power/Ground, NC----No Connection

(2) Unused I/O pin should be fixed to GND level.

(3) Select the MPU system interface mode

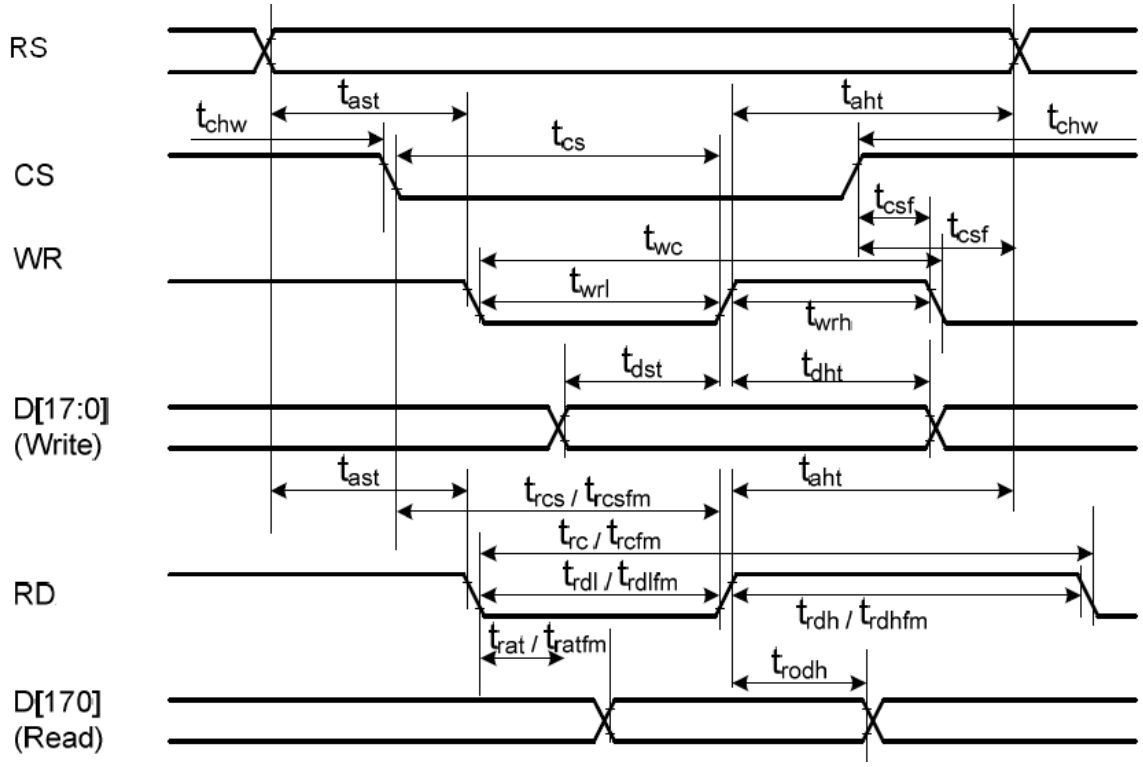
IM2	IM1	IM0	Interface	Data Bus Use	
				Register/Content	GRAM
0	0	0	DBI type B 18_bit	D17~D0	D7~D0
0	0	1	DBI type B 9_bit	D8~D0	D7~D0
0	1	0	DBI type B 16_bit	D15~D0	D7~D0
0	1	1	DBI type B 8_bit	D7~D0	D7~D0
1	0	1	DBI type C 3_wire 9_bit	-	-
1	1	1	DBI type C 4_wire 8_bit	-	-

■ REFERENCE APPLICATION NOTES

MPU Interface

1.1 Timing Parameter DBI Type B

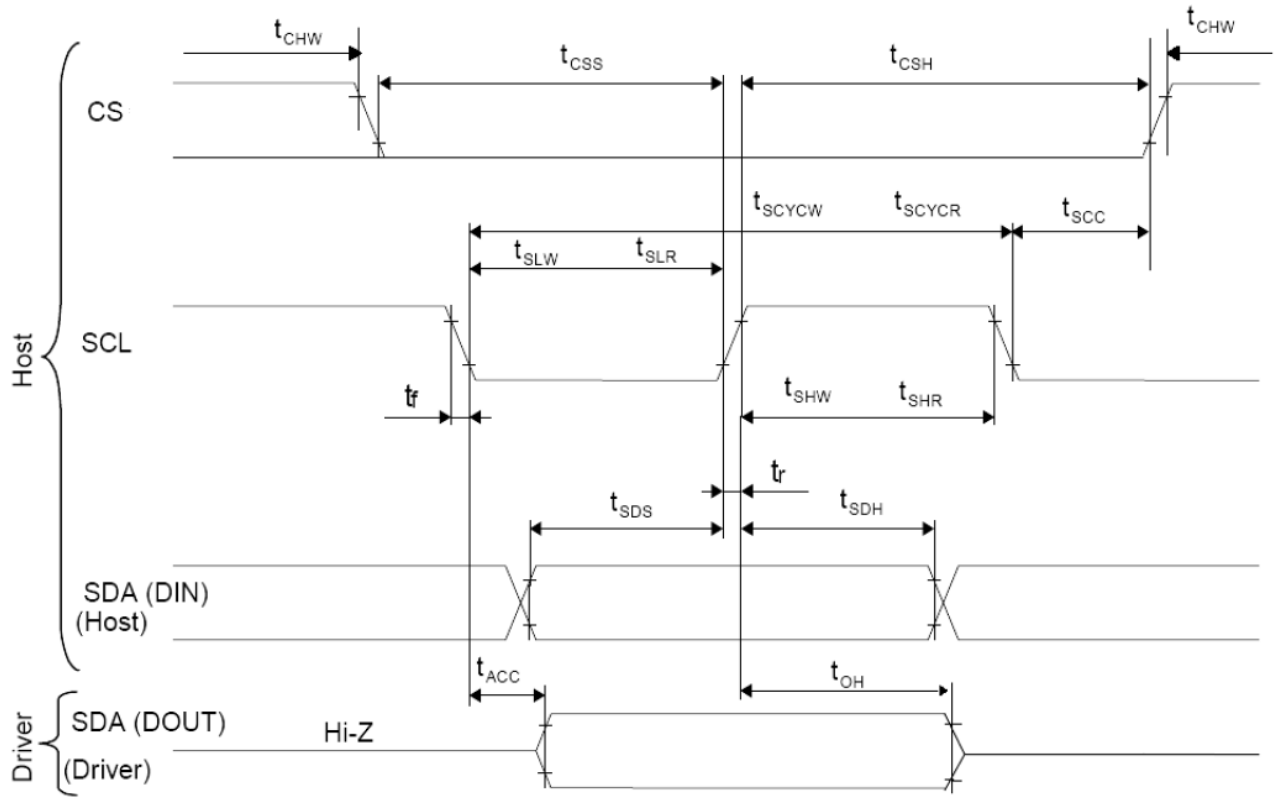
1.1.1 Display Parallel 18/16/9/8bit Interface Timing Characteristic(8080-series)



Signal	Symbol	Parameter	min	max	Unit	Description
RS	tast	Address setup time	0	-	ns	-
	taht	Address hold time (Write/Read)	0	-	ns	-
CS	tchw	CSX "H" pulse width	0	-	ns	-
	tcs	Chip Select setup time (Write)	15	-	ns	-
	trcs	Chip Select setup time (Read ID)	45	-	ns	-
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	-
	tcsf	Chip Select Wait time (Write/Read)	0	-	ns	-
WR	twc	Write cycle	66	-	ns	-
	twrh	Write Control pulse H duration	15	-	ns	-
	twrl	Write Control pulse L duration	15	-	ns	-
RD(FM)	trcfm	Read Cycle (FM)	450	-	ns	When read from Frame Memory
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RD(ID)	trc	Read cycle (ID)	160	-	ns	When read ID data
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
DB[17:0], DB[15:0], DB[8:0] DB[7:0]	tdst	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

Table 1.1.1 Display Parallel Interface Timing (8080-series)

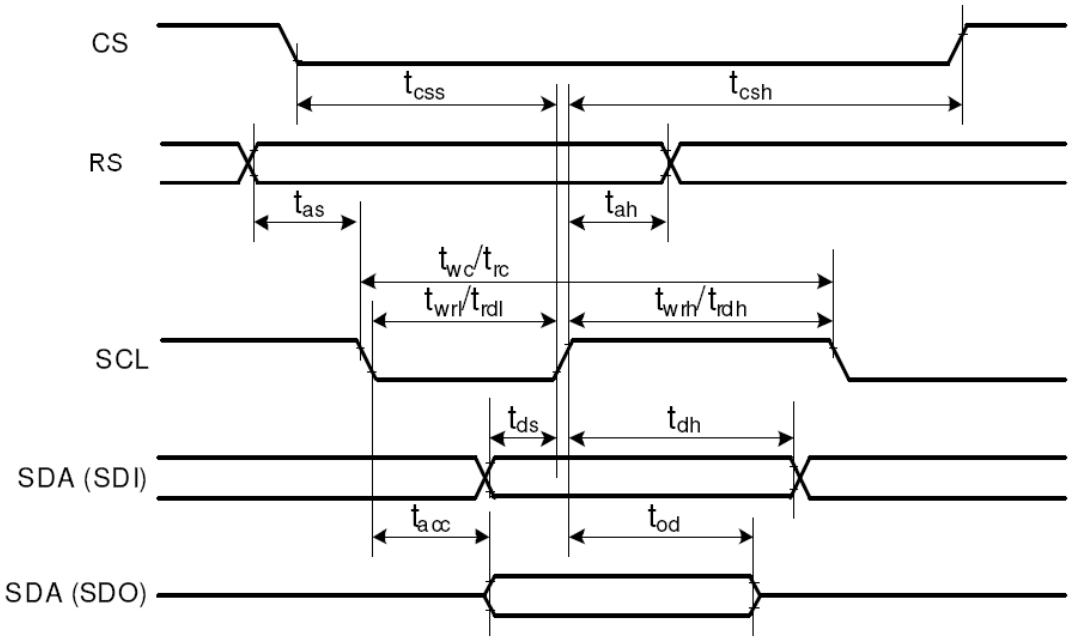
1.1.2 Display Serial Interface Timing Characteristic(3-Line SPI Interface)



Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	66	-	ns	
	tshw	SCL "H" Pulse Width (Write)	15	-	ns	
	tslw	SCL "L" Pulse Width (Write)	15	-	ns	
	tscycr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
	tslr	SCL "L" Pulse Width (Read)	60	-	ns	
SDA / SDI (Input)	tsds	Data setup time (Write)	10	-	ns	
	tsdh	Data hold time (Write)	10	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	50	ns	
	toh	Output disable time (Read)	15	50	ns	
CS	tscc	SCL-CSX	15	-	ns	
	tchw	CSX "H" Pulse Width	40	-	ns	
	tcss	CSX-SCL Time	60	-	ns	
	tcsh		65	-	ns	

Table 1.1.2 3-Line SPI Interface Timing

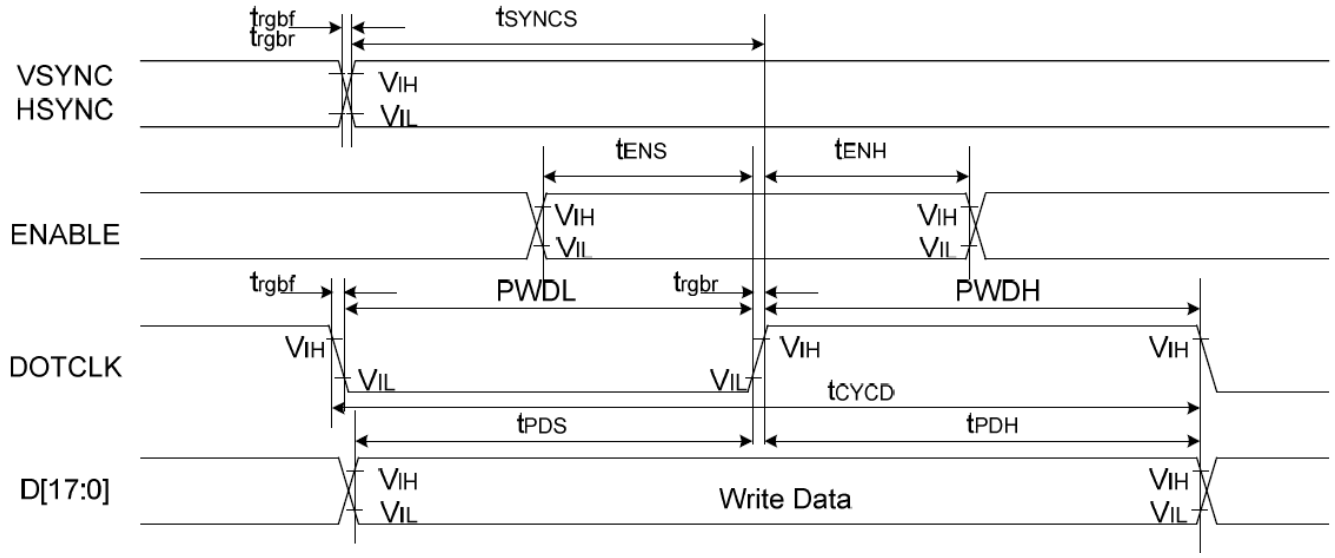
1.1.3 Display Serial Interface Timing Characteristic(4-Line SPI Interface)



Signal	Symbol	Parameter	min	max	Unit	Description
CS	tcss	Chip select time (Write)	15	-	ns	
	tcsh	Chip select hold time (Read)	60	-	ns	
SCL	twc	Serial clock cycle (Write)	66	-	ns	
	twrh	SCL "H" pulse width (Write)	15	-	ns	
	twrl	SCL "L" pulse width (Write)	15	-	ns	
	trc	Serial clock cycle (Read)	150	-	ns	
	trdh	SCL "H" pulse width (Read)	60	-	ns	
	trdl	SCL "L" pulse width (Read)	60	-	ns	
RS	tas	D/CX setup time	10	-	ns	
	tah	D/CX hold time (Write / Read)	10	-	ns	
SDA / SDI (Input)	tds	Data setup time (Write)	10	-	ns	
	tdh	Data hold time (Write)	10	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	50	ns	For maximum CL=30pF
	tod	Output disable time (Read)	15	50	ns	For minimum CL=8pF

Table 1.1.3 4-Line SPI Interface Timing

1.1.4 Parallel 18/16bit RGB Interface Timing Characteristic



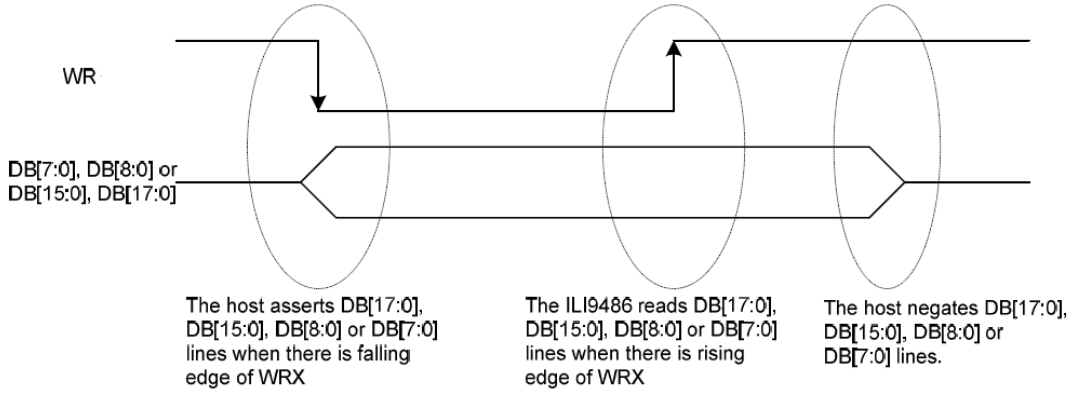
Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
ENABLE	t_{ENS}	ENABLE setup time	15	-	ns	
	t_{ENH}	ENABLE hold time	15	-	ns	
DB[17:0]	t_{POS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	15	-	ns	
	PWDL	DOTCLK low-level period	15	-	ns	
	t_{CYCD}	DOTCLK cycle time	66	-	ns	
	t_{rgbr} , t_{rgbf}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	

Note: Ta = -30 to 70 ℃, IOVCC=1.65V to 3.6V, VCI=2.5V to 3.3V, AGND=DGND=0V

Table 1.1.4 RGB Interface Timing

1.2 Register write/read timing(DBI type C)

1.2.1 Write to register



Note: WR is an unsynchronized signal (It can be stopped)

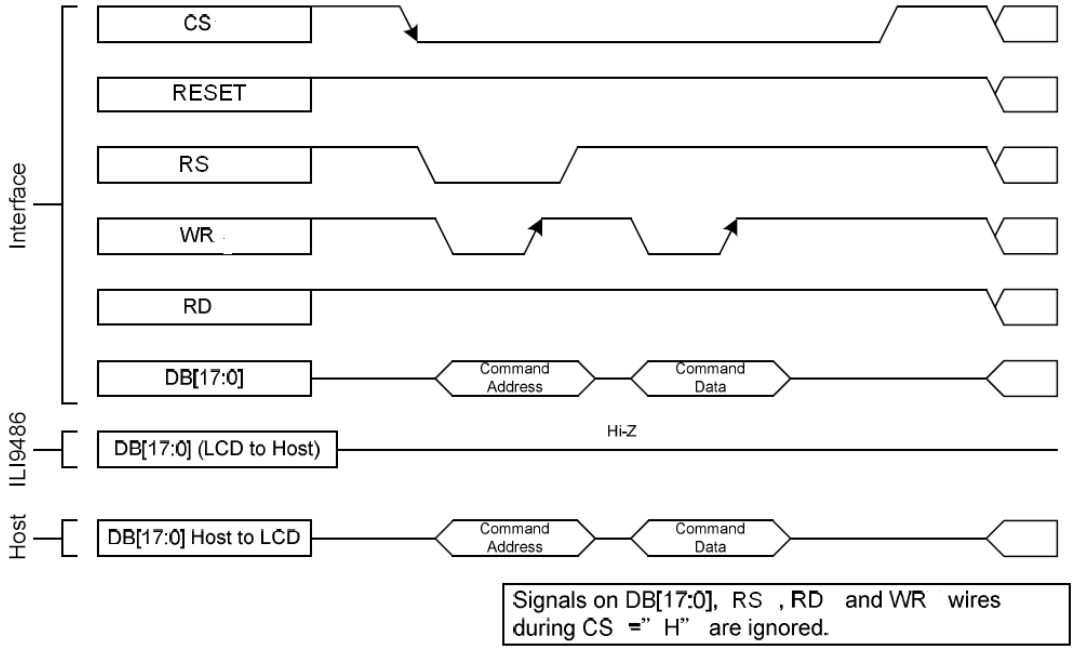


Figure 1.2.1 Register Write Timing In Parallel Bus System Interface (for I80 series MPU)

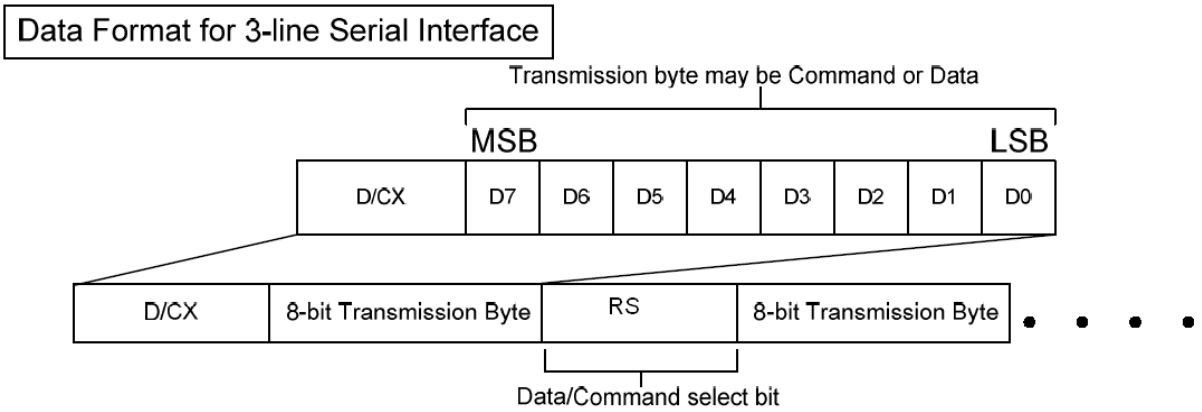


Figure 1.2.2 Register Write Timing In 3-SPI Interface

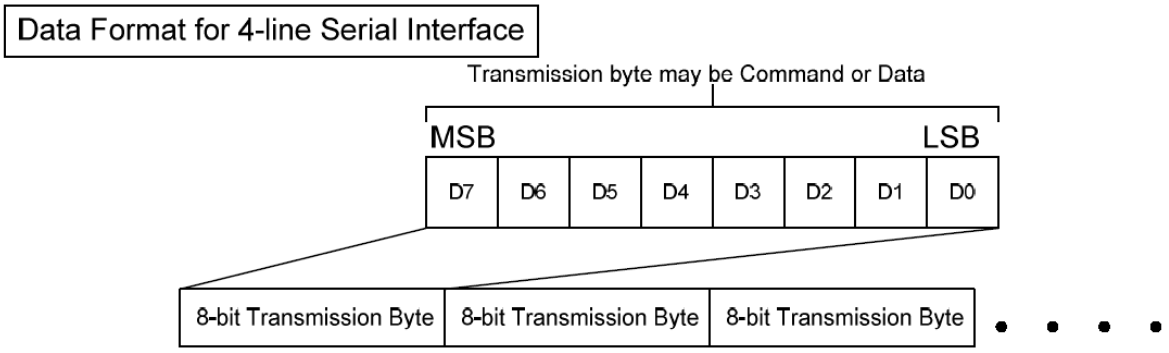
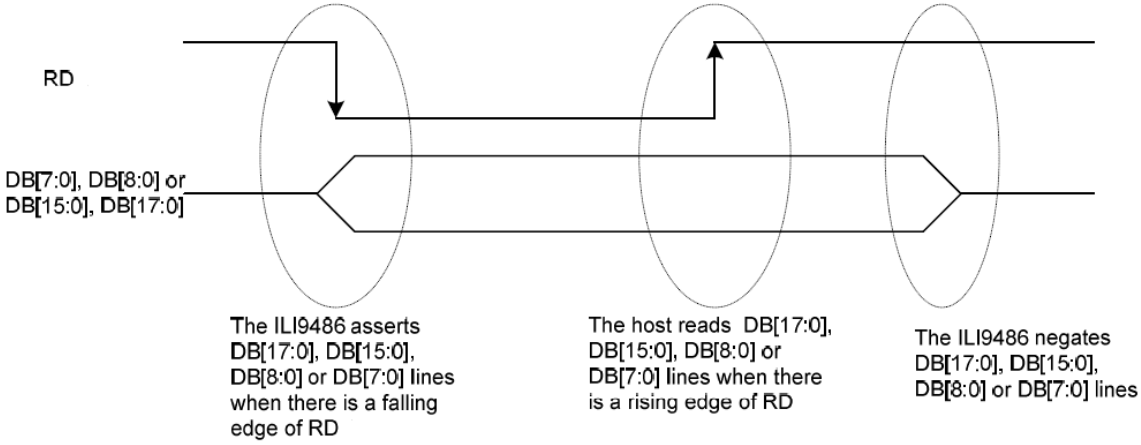


Figure 1.2.3 Register Write Timing In 4-SPI Interface

1.2.2 Read from register



Note: RD is an unsynchronized signal (It can be stopped).

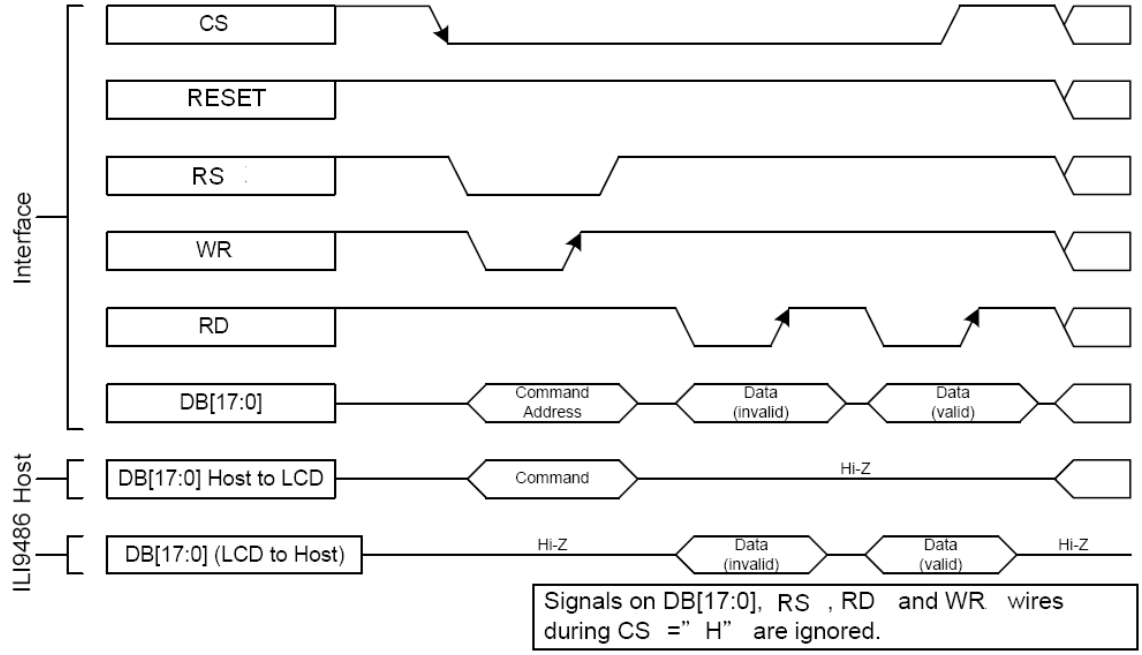


Figure 1.2.4 Register Read Timing In Parallel Bus System Interface (for I80 series MPU)

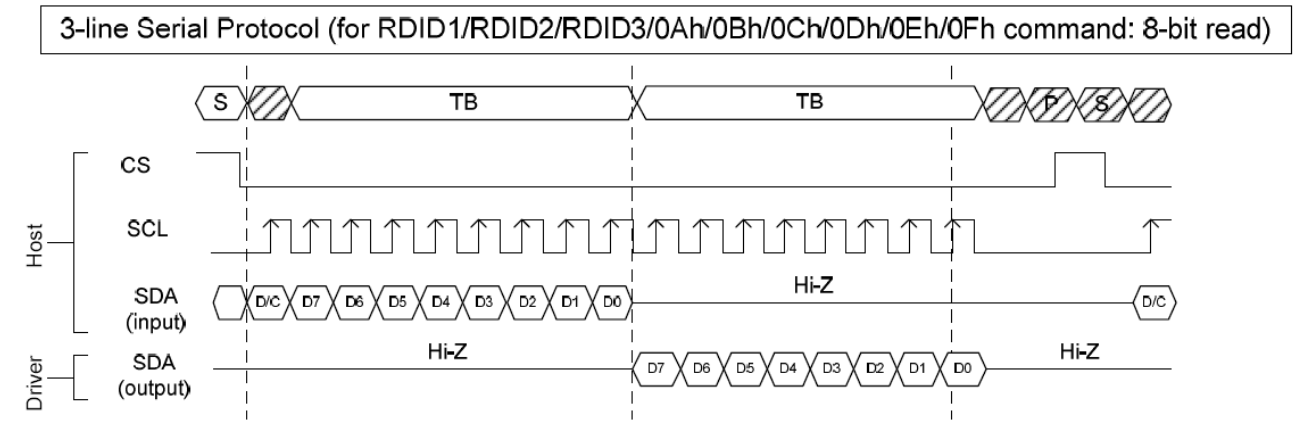


Figure 1.2.5 Register Read Timing In 3-SPI Interface

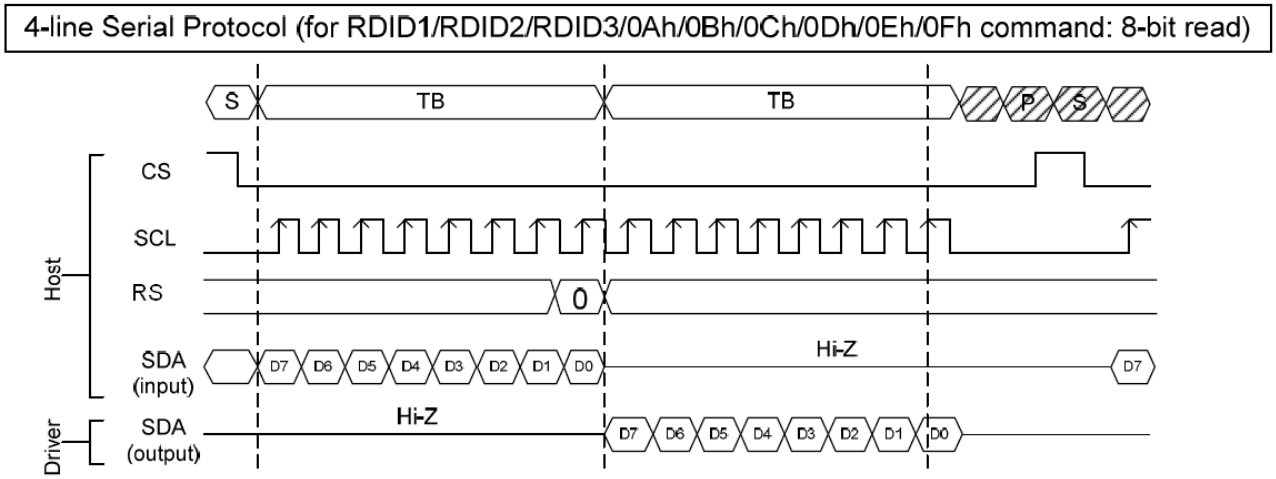


Figure 1.2.6 Register Read Timing In 4-SPI Interface

1.3 DPI Data Format

18 bit/pixel color order (R:6-bit, G:6-bit, B:6-bit), 262,144 colors

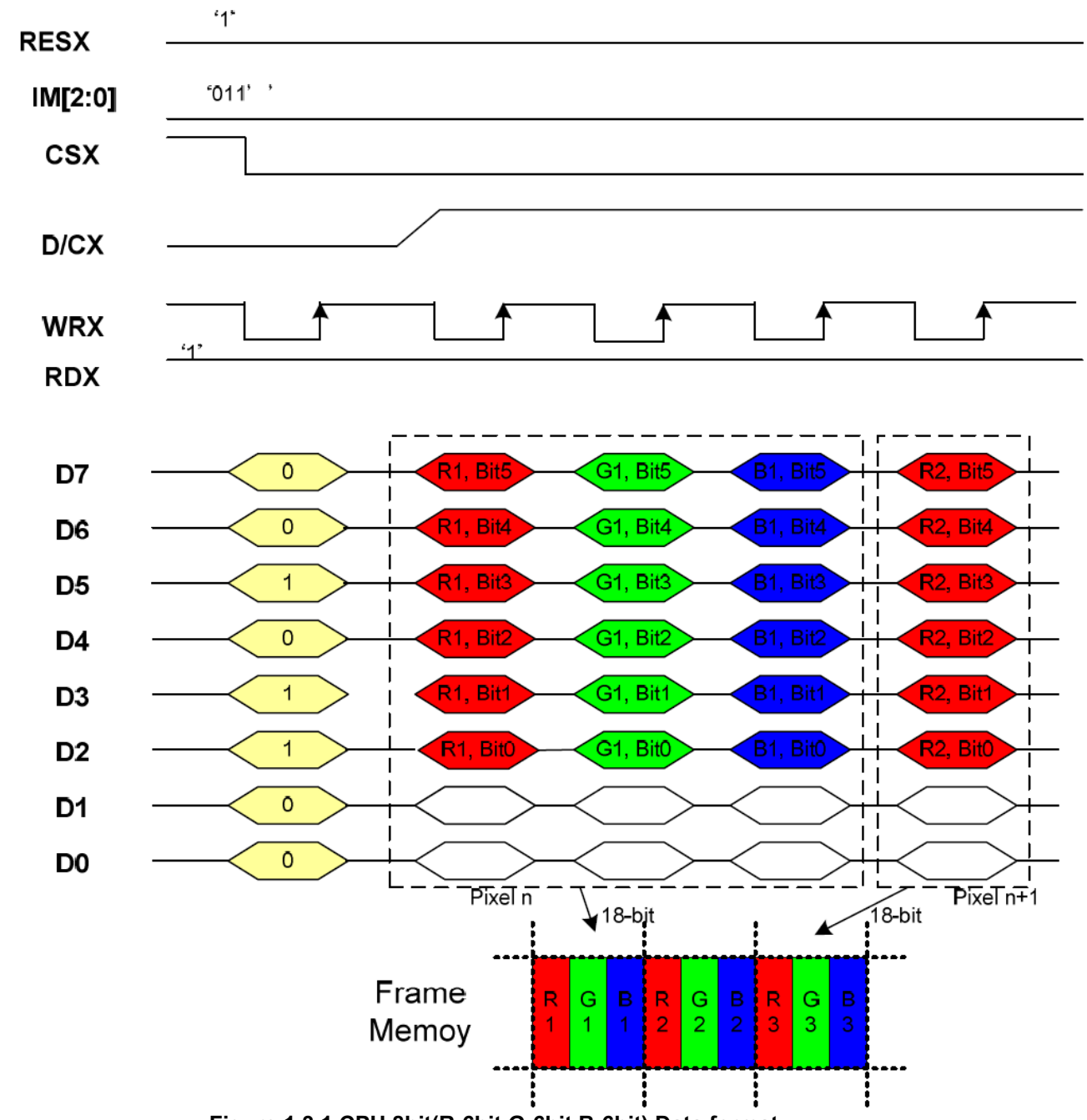


Figure 1.3.1 CPU 8bit(R:6bit,G:6bit.B:6bit) Data format

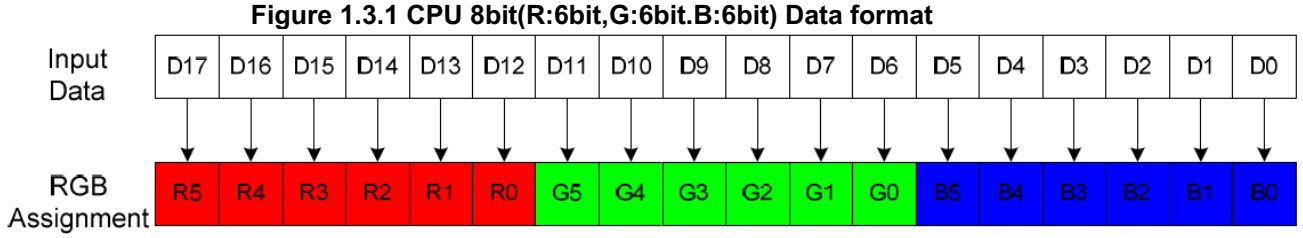


Figure 1.3.2 RGB 18bit Data format

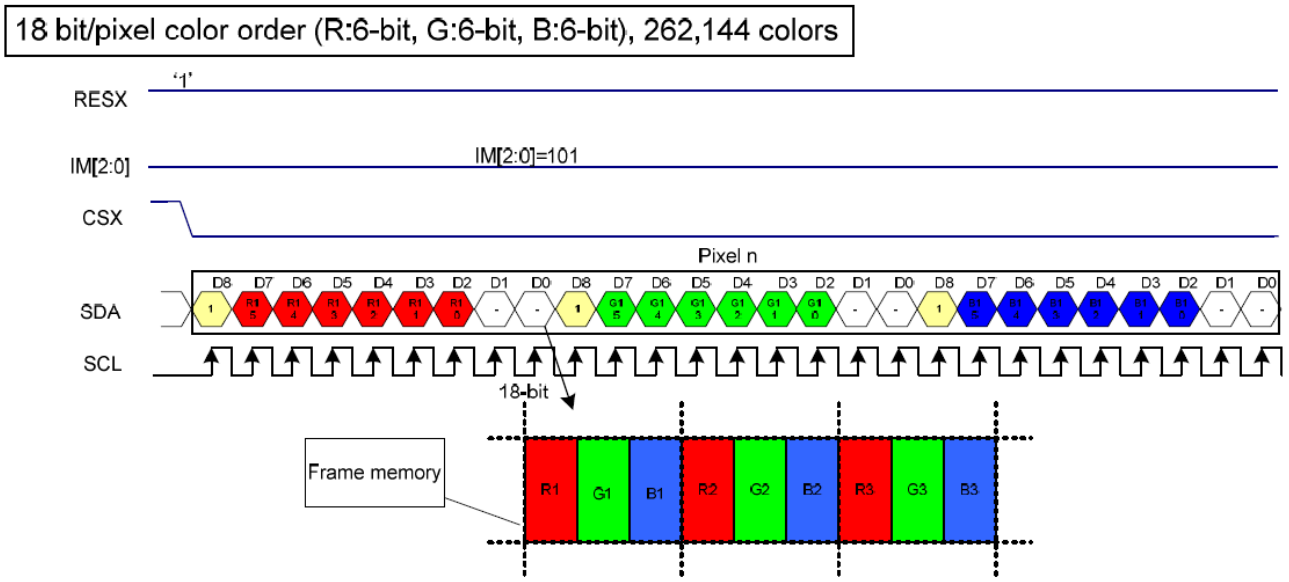


Figure 1.3.3 3-SPI Data format

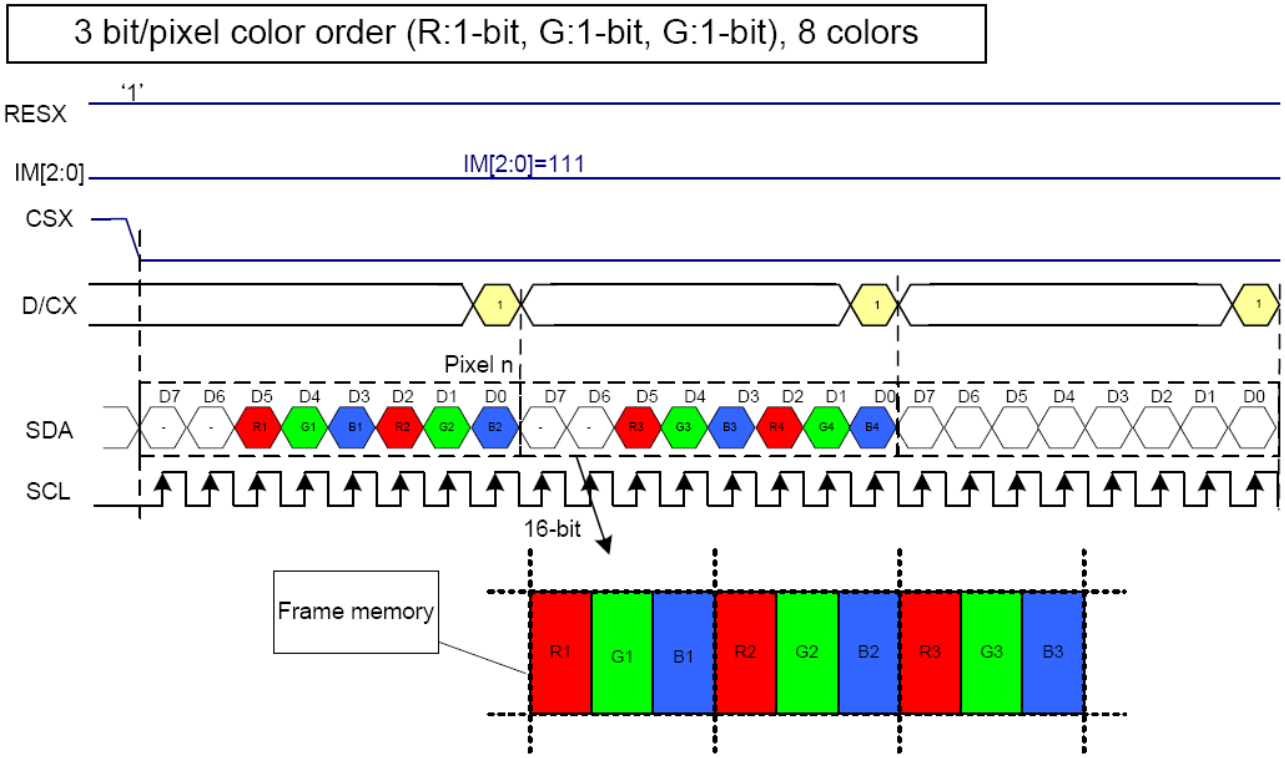
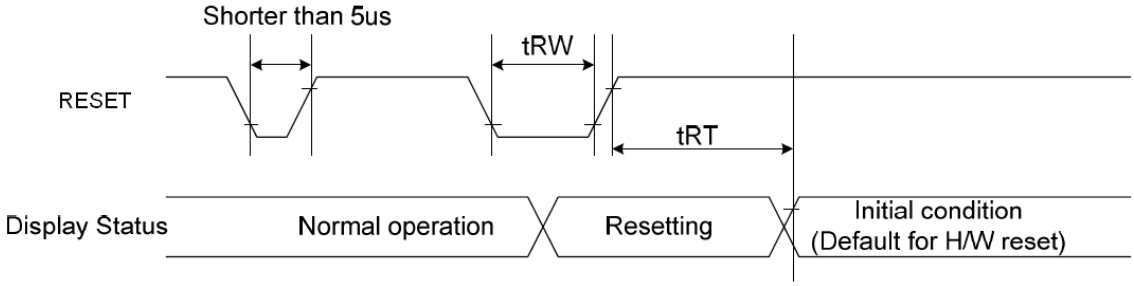


Figure 1.3.4 4-SPI Data format

1.4 Reset Timing Characteristics



Signal	Symbol	Parameter	Min	Max	Unit
RESET	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5)	mS
				120 (note 1,6,7)	mS

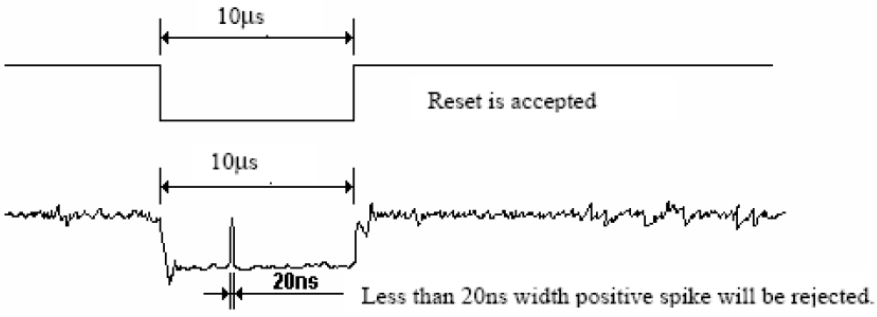
Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from EEPROM to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESET

Note 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

Note 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.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:



Note 5: When Reset applied during Sleep In Mode.

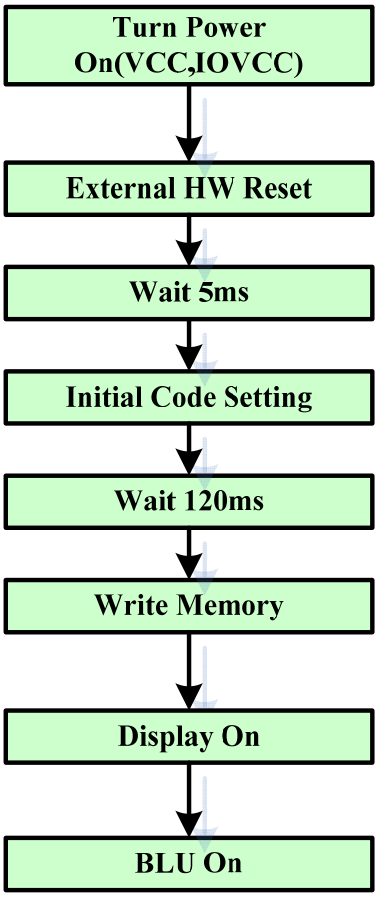
Note 6: When Reset applied during Sleep Out Mode.

Note7: It is necessary to wait 5msec after releasing RESET *before sending commands. Also Sleep Out command cannot be sent for 120msec.*

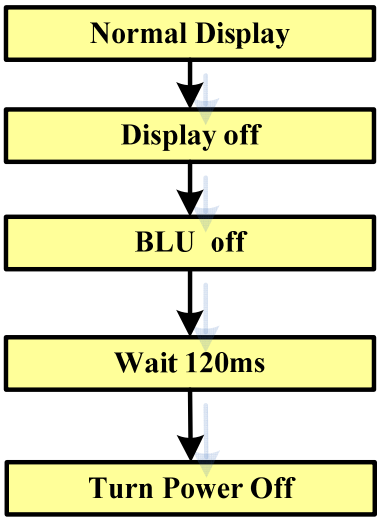
Figure 1.4 RESET Timing

1.5 Power On/Off sequence

1.5.1 Power on Sequence



1.5.2 Power off Sequence



■ RELIABILITY TEST CONDITIONS

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	80±2℃/200 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℃/200 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℃×10cycles	
6	Damp proof Test operating	50℃±5℃×90%RH/120 hours	
7	Vibration Test	Frequency：10Hz~55Hz~10Hz Amplitude：1.5mm, X，Y，Z direction for total 3hours (Packing condition)	
8	Dropping test	Drop to the ground from 1m height, one time, every side of carton. (Packing condition)	
9	ESD test	Voltage:±8KV R: 330Ω C: 150pF Air discharge, 10time	

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 4
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	MDS Product

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

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:

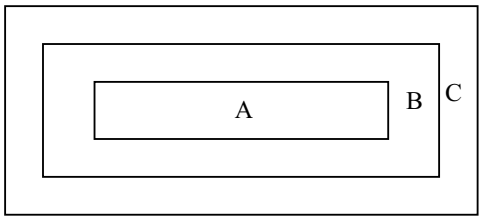
Major defect: AQL 0.65

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.

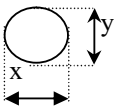
OUTGOING QUALITY STANDARD	PAGE 2 OF 4
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	MDS Product

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.	

4.2 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, Dirt under polarizer	For dark/white spot, sizeΦis defined as Φ= $\frac{(x+y)}{2}$  1.	Minor
	Dim Spots Circle shaped and dim edged defects	2.	Minor

1.

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

2.

Size(mm) \ 2. Zone	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.20＜Φ≤0.40	3		
0.40＜Φ≤0.60	2		
0.60＜Φ≤0.80	1		
0.80＜Φ	0		

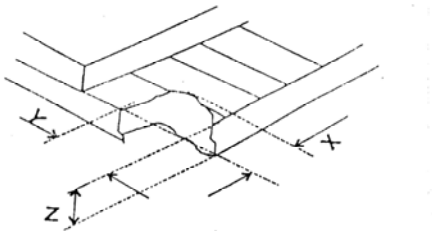
OUTGOING QUALITY STANDARD	PAGE 3 OF 4
TITLE: FUNCTIONAL TEST & INSPECTION CRITERIA	MDS Product

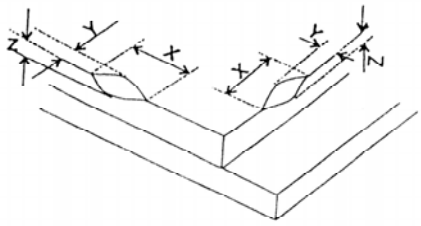
4.2. Cosmetic Defect

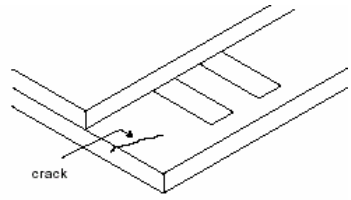
<table>
<tr><th>Item No</th><th>Items to be inspected</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td>4.2.2</td><td>Line defect
Black line,
White line,
Foreign material under polarizer,</td><td>
<table>
<tr><th colspan="2">Size(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th rowspan="2">L(Length)</th><th rowspan="2">W(Width)</th><th colspan="3">Zone</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Ignore</td><td>W≤0.02</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>L≤3.0</td><td>0.02＜W≤0.03</td><td colspan="2">2</td></tr>
<tr><td>L≤2.0</td><td>0.03＜W≤0.05</td><td colspan="2">1</td></tr>
<tr><td></td><td>0.05＜W</td><td colspan="2">Define as spot defect</td></tr>
</table>
</td><td>Minor</td></tr>
<tr><td>4.2.3</td><td>Polarizer scratch</td><td>If the Polarizer 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 Polarizer scratch can be seen only in non-operating condition or some special angle, judge by the following.
<table>
<tr><th colspan="2">Size(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th rowspan="2">L(Length)</th><th rowspan="2">W(Width)</th><th colspan="3">Zone</th></tr>
<tr><th>A</th><th>B</th><th>C</th></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><th rowspan="2">2. Zone
Size(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></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>

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

4.3. Cosmetic Defect

<table>
<tr><th>Item No</th><th>Items to be inspected</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="3">4.3.5</td><td rowspan="3">Glass defect</td><td>(i) Chips on corner
 

<table><tr><th>X</th><th>Y</th><th>Z</th></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>
<tr><td>(ii)Usual surface cracks
 

<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0</td><td><Inner border line of the seal</td><td>Disregard</td></tr></table></td><td>Minor</td></tr>
<tr><td>(iii) Crack
Cracks tend to break are not allowed.
 
</td><td>Major</td></tr>
<tr><td>4.3.6</td><td>Parts alignment</td><td>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.</td><td>Minor</td></tr>
<tr><td>4.3.7</td><td>SMT</td><td>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.</td><td></td></tr>
</table>

■ 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.

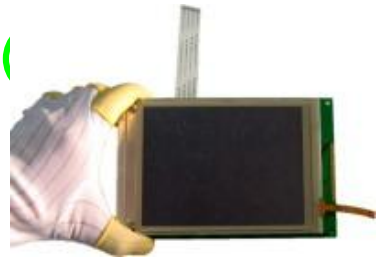
1.13 Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- 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.

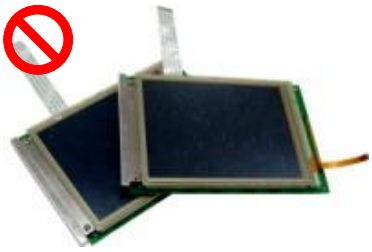
2.2 Correct handling:



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

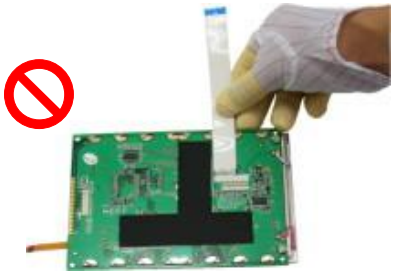
2.3 Incorrect handling:

Please don't touch IC directly.

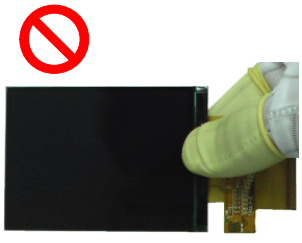


Please don't stack LCM.

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 Others 其它

3.2.1 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.

3.2.2 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.

3.2.3 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.

3.2.3.1 - Exposed area of the printed circuit board.

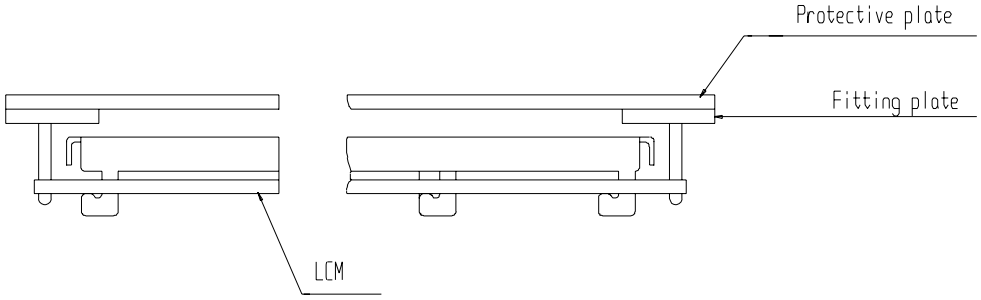
3.2.3.2 -Terminal electrode sections.

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.

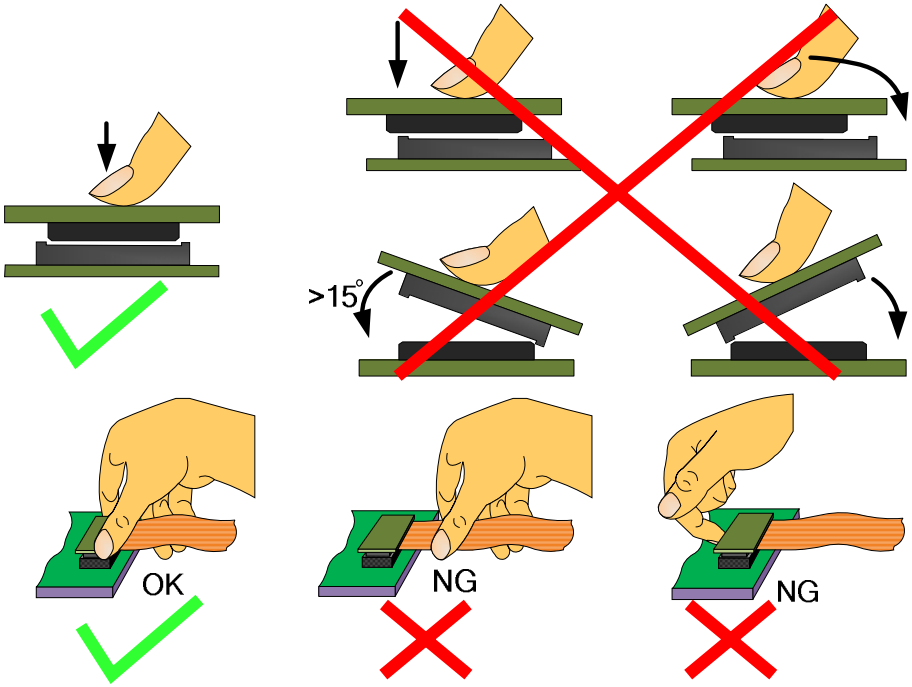
4.1.1 Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



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 : 15-17 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. Speed : 15-17 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 betweenMulti-Inno and customer,Multi-Inno will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with Multi-Inno LCD acceptance standards (copies available upon request) for a period of one year from date of production. Cosmetic/visual defects must be returned to Multi-Innowithin 90 days of shipment. Confirmation of such date shall be based on data code on product. The warranty liability ofMulti-Inno limited to repair and/or replacement on the terms set forth above. Multi-Inno will not be responsible for any subsequent or consequential events.

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 notice on 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.