MULTI-INNO TECHNOLOGY CO., LTD.

www.multi-inno.com

LCD MODULE SPECIFICATION

Model : MI0320QT-1

This module uses ROHS material

For Customer's Acceptance:

Customer	
Approved	
Comment	

This specification may change without prior notice in order to improve performance or quality. Please contact Multi-Inno for updated specification and product status before design for this product or release of this order.	Revision	1.0
	Engineering	
	Date	2013-08-25
	Our Reference	

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2013-08-25	First Release	

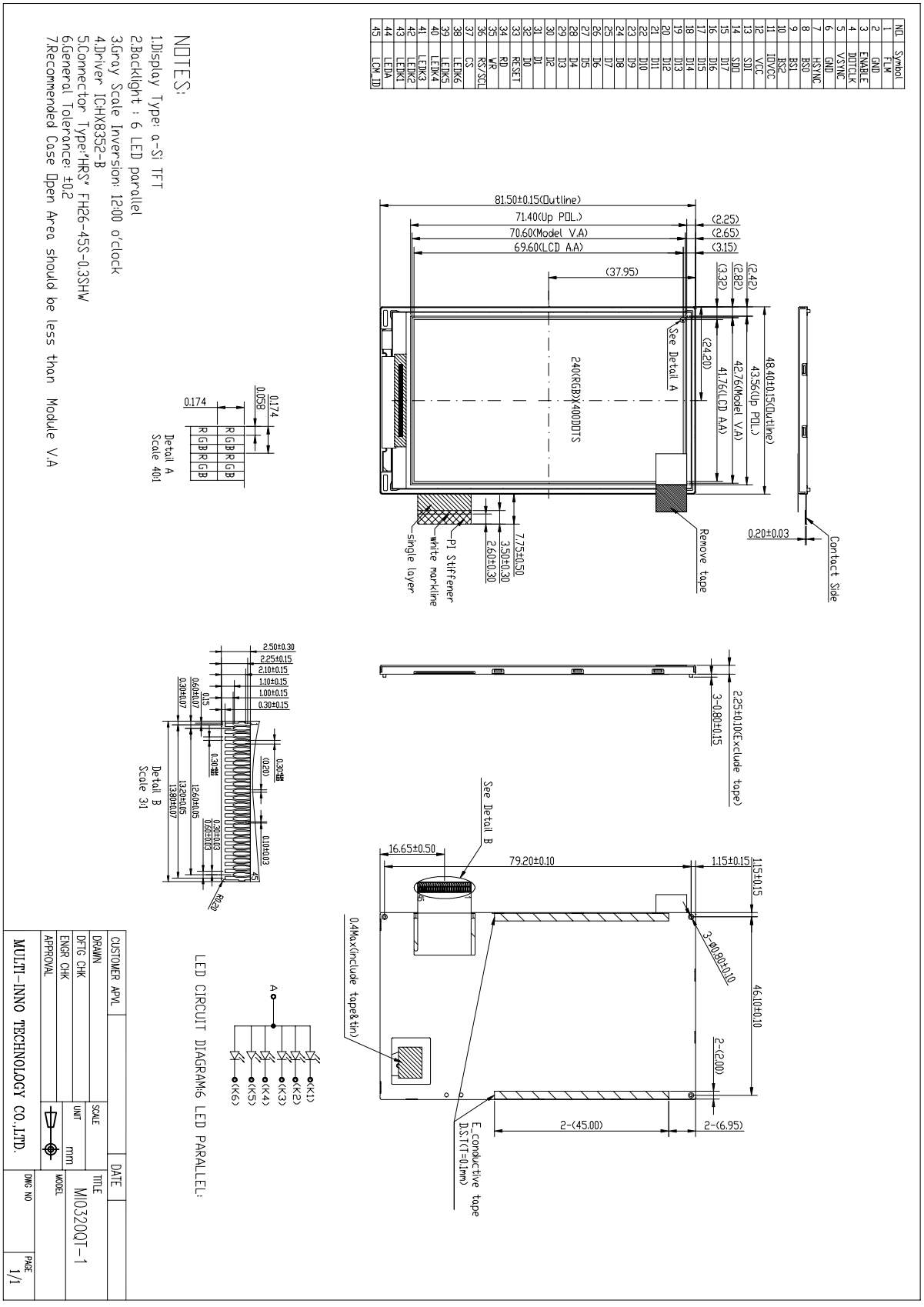
CONTENTS

■ GENERAL INFORMATION

Item	Contents	Unit
LCD type	TFT/Transmissive/Normally white	/
Size	3.2	Inch
Viewing direction	6:00 (without image inversion and least brightness change)	O' Clock
Gray scale inversion direction	12:00 (contrast peak located at)	O' Clock
LCM (W × H × D)	48.40×81.50×2.25	mm^3
Active area (W×H)	41.76×69.60	mm^2
Pixel pitch (W×H)	0.174×0.174	mm^2
Number of dots	240 (RGB) × 400	/
Driver IC	HX8352-B	/
Backlight type	6 LEDs	/
Interface type	CPU/SPI+RGB 18bits/16bits/8bits	/
Color depth	262K/65K	/
Pixel configuration	R.G.B vertical stripe	/
Surface treatment(Up polarizer)	Clear type(3H)	/
Input voltage	2.8	V
With/Without TSP	Without TSP	/
Weight	TBD	g

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

■ EXTERNAL DIMENSIONS



■ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Supply voltage	VCC	-0.3	4.6	V
Supply voltage	IOVCC	-0.3	4.6	V
Input signal voltage	VIN	-0.3	VCC+0.3	V
Back light forward current	I_{LED}	-	25	mA
Operating temperature	T_{OP}	-20	70	°C
Storage temperature	T_{ST}	-30	80	°C
Humidity	RH	-	90%(Max60°C)	RH

Note :VIN: D[17:0],CS,RD,WR,RS/SCL,SDI,VSYNC,HSYNC,DOTCLK,ENABLE,RESET,BS[2:0]

■ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

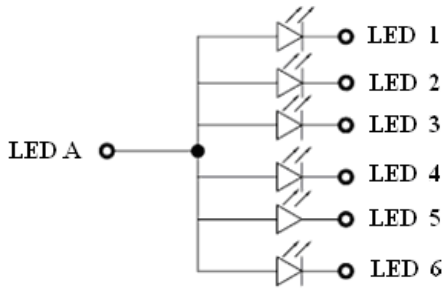
Parameter	Symbol	Min	Typ	Max	Unit
Logic& analog power supply	VCC	2.5	2.8	3.3	V
IO pad power supply	IOVCC	1.65	1.8/2.8	3.3	V
Input voltage ' H ' level	V_{IH}	0.8IOVCC	-	IOVCC	V
Input voltage ' L ' level	V_{IL}	0	-	0.2IOVCC	V
Output voltage ' H ' level	V_{OH}	0.7IOVCC	-	IOVCC	V
Output voltage ' L ' level	V_{OL}	-0.3	-	0.3IOVCC	V
(Panel+LSI) Power consumption	Black mode(60Hz)	-	-	TBD	mA
	8 color mode	-	-	TBD	mA
	Standby mode	-	-	TBD	mA

Note 1:VIH/VIL: D[17:0],CS,RD,WR,RS/SCL,SDI,VSYNC,HSYNC,DOTCLK,ENABLE,RESET,BS[2:0]
Note 2:VOH/VOL: SDO,FLM

■ BACKLIGHT CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage	Vf	-	3.2	-	V	6 LEDs (in parallel)
Forward current	If	-	90	-	mA	
Power consumption	W_{BL}	-	288	-	mW	
Operating life time	-	20000	-	-	Hrs	

Note1: Figure below shows the connection of backlight LED.



Note 2: One LED : I_F (1/6)=15mA, V_F =3.2V

■ELECTRO-OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time		Tr+Tf	θ=0° ∅=0° Ta=25℃	-	25	40	ms	FIG 1.	4
Contrast ratio		Cr		400	500	-	---	FIG 2.	1
Luminance uniformity		δ WHITE		-	80	-	%	FIG 2.	3
Surface Luminance		Lv		280	310	-	cd/m^2	FIG 2.	2
Viewing angle range		θ	∅ = 90°	60	70	-	deg	FIG 3.	6
			∅ = 270°	45	55	-	deg	FIG 3.	
			∅ = 0°	60	70	-	deg	FIG 3.	
			∅ = 180°	60	70	-	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		0.230	0.280	0.330			
		y		0.240	0.290	0.340			
NTSC	-	-	-	55	60	-	%	-	-

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".

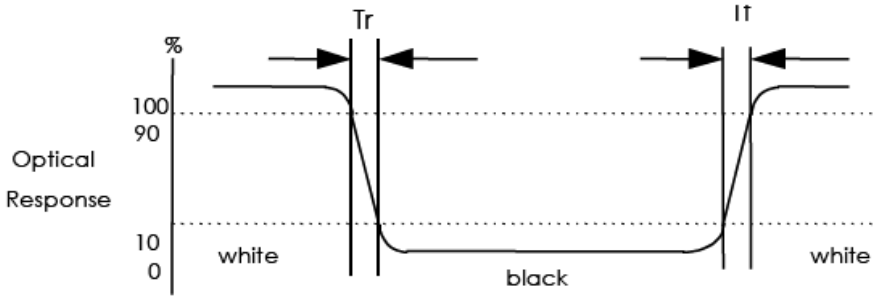
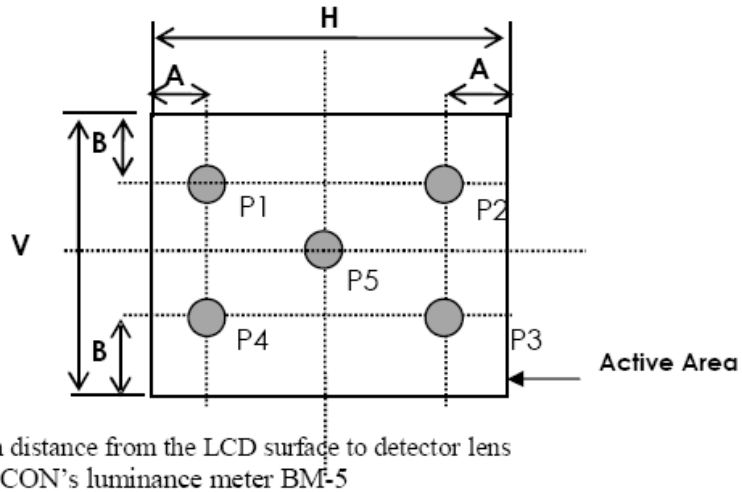
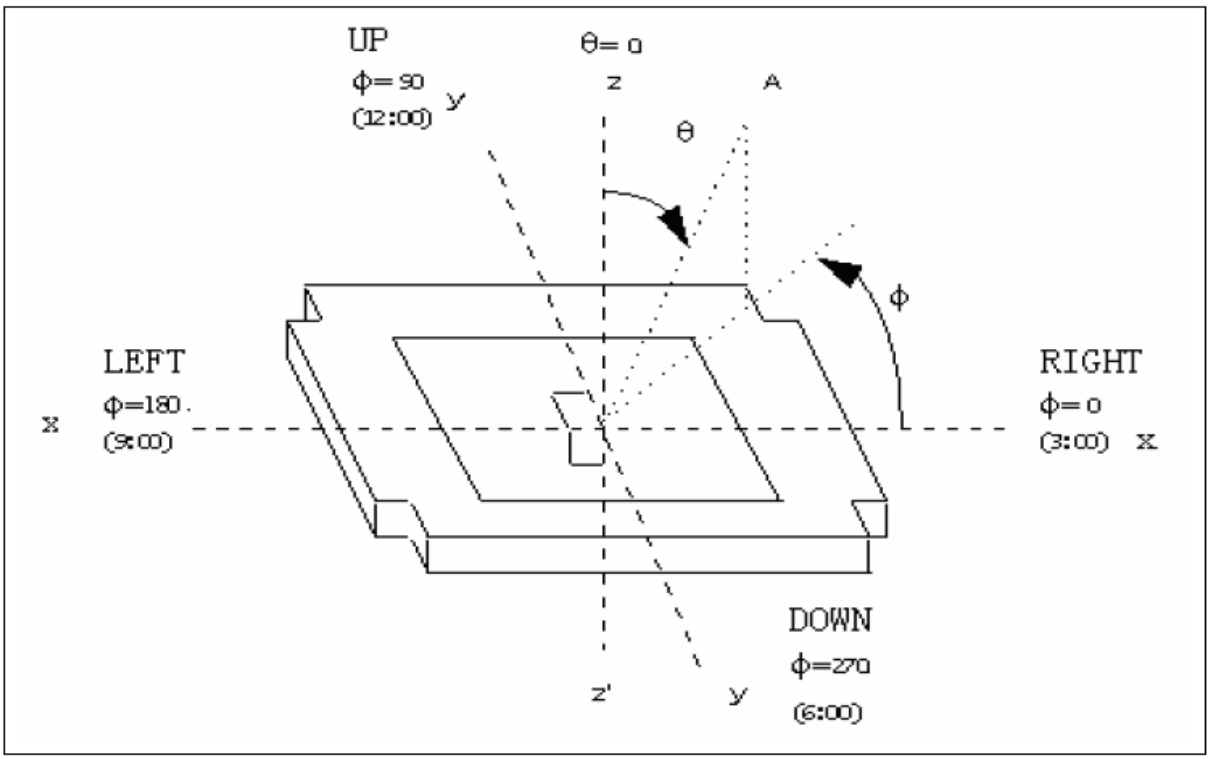


FIG. 2 Measuring method for Contrast ratio, surface luminance, Luminance uniformity , CIE (x, y) chromaticity



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

Connector Type:FH26-45S-0.3SHW

No	SYMBOL	I/O	Description	Remark
1	FLM	O	Tearing effect output	
2	GND	P	Ground	
3	ENABLE	I	A data ENABLE signal in RGB I/F mode; Has to be fixed to GND level if is not used	
4	DOTCLK	I	Dot clock signal in RGB I/F mode; Has to be fixed to GND level if is not used	
5	VSYNC	I	Frame synchronizing signal in RGB I/F mode; Has to be fixed to IOVCC level if is not used	
6	GND	P	Ground	
7	HSYNC	I	Line synchronizing signal in RGB I/F mode; Has to be fixed to IOVCC level if is not used	
8	BS0	I	Interface selection	Note 2
9	BS1	I	Interface selection	Note 2
10	BS2	I	Interface selection	Note 2
11	IOVCC	P	Digital I/O power supply	
12	VCC	P	Digital power supply	
13	SDI	I	Serial data input; If not used, please let it connected to IOVCC or GND level	
14	SDO	O	Serial data output	
15	D17	I	Data input	
16	D16	I	Data input	
17	D15	I	Data input	
18	D14	I	Data input	
19	D13	I	Data input	
20	D12	I	Data input	
21	D11	I	Data input	
22	D10	I	Data input	
23	D9	I	Data input	
24	D8	I	Data input	
25	D7	I	Data input	
26	D6	I	Data input	
27	D5	I	Data input	
28	D4	I	Data input	
29	D3	I	Data input	
30	D2	I	Data input	
31	D1	I	Data input	
32	D0	I	Data input	
33	RESET	I	Reset signal; Must be reset after power is supplied	
34	RD	I	Read signal; Fix it to IOVCC or GND level when using serial bus interface	

35	WR	I	Write signal; Fix it to IOVCC or GND level when using serial bus interface	
36	RS/SCL	I	Command or parameter select signal under parallel mode; Low: command, High: parameter. When under serial interface, it servers as clock signal.	
37	CS	I	Chip select signal, low: chip can be accessed; Must be connected to GND if is not used	
38	LED6	P	Back light cathode LED6	
39	LED5	P	Back light cathode LED5	
40	LED4	P	Back light cathode LED4	
41	LED3	P	Back light cathode LED3	
42	LED2	P	Back light cathode LED2	
43	LED1	P	Back light cathode LED1	
44	LEDA	P	Back light anode	
45	LCM_ID	O	ID pin	

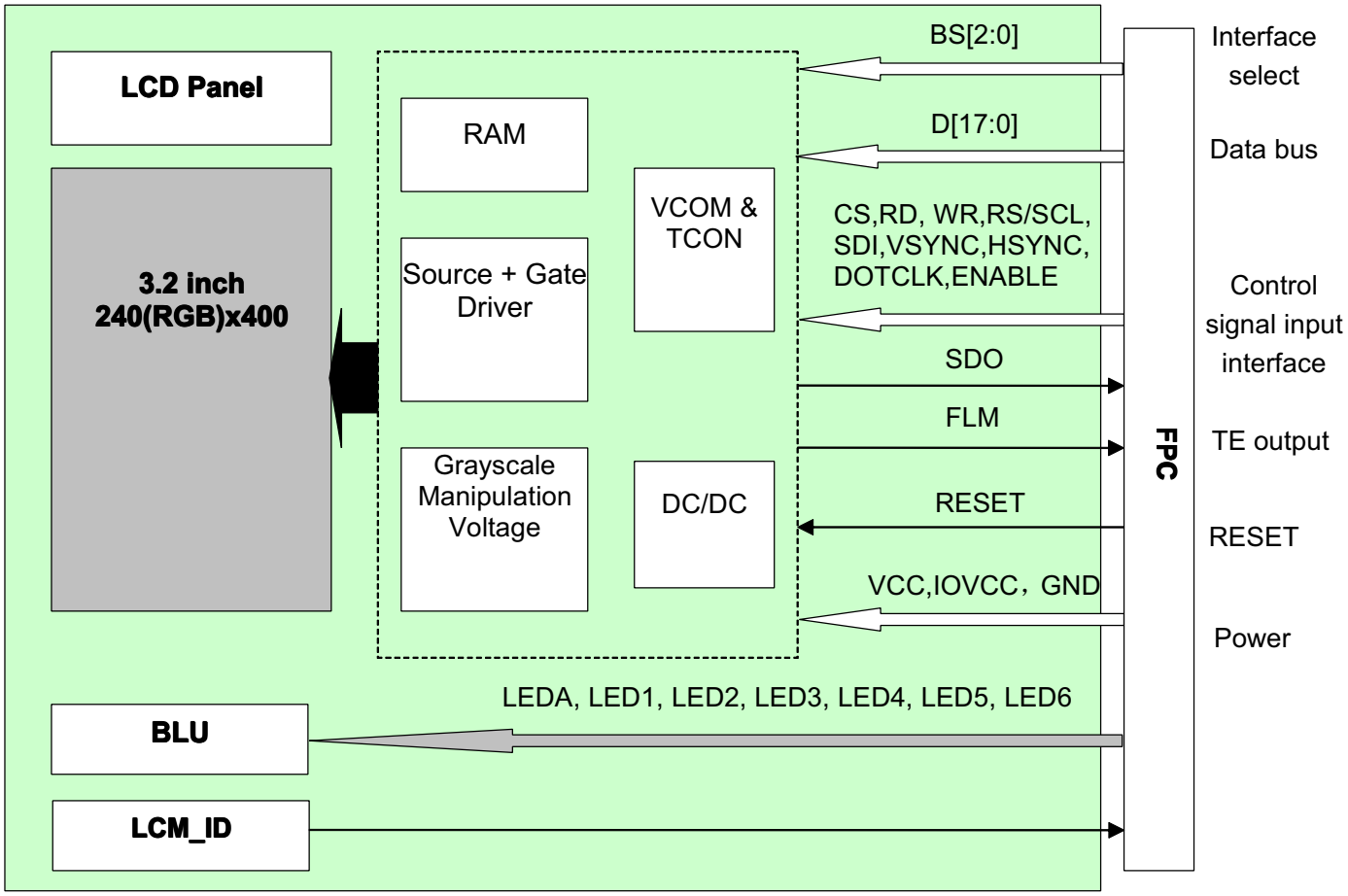
Note 1: I/O definition：

I-----Input O---Output P----Power(Ground)

Note 2: Interface selection：

BS2	BS1	BS0	Interface Mode	DB pins
0	0	0	16-bit bus interface, 80-system, 65k-color	D15-D0: Data; D17-D16: Unused;
0	0	1	16-bit bus interface, 80-system, 262k-color	D15-D0: Data; D17-D16: Unused;
0	1	0	18-bit bus interface, 80-system, 262k-color	D17-D0: Data;
0	1	1	8-bit bus interface, 80-system, 262k-color	D7-D0: Data; D17-D8: Unused;
1	0	0	8-bit bus interface, 80-system, 65k-color	D7-D0: Data; D17-D8: Unused;
1	1	ID	SPI+RGB interface	D17-D0: Data;

■BLOCK DIAGRAM



■ APPLICATION NOTES

1. CPU Interface

1.1 Interface Characteristics

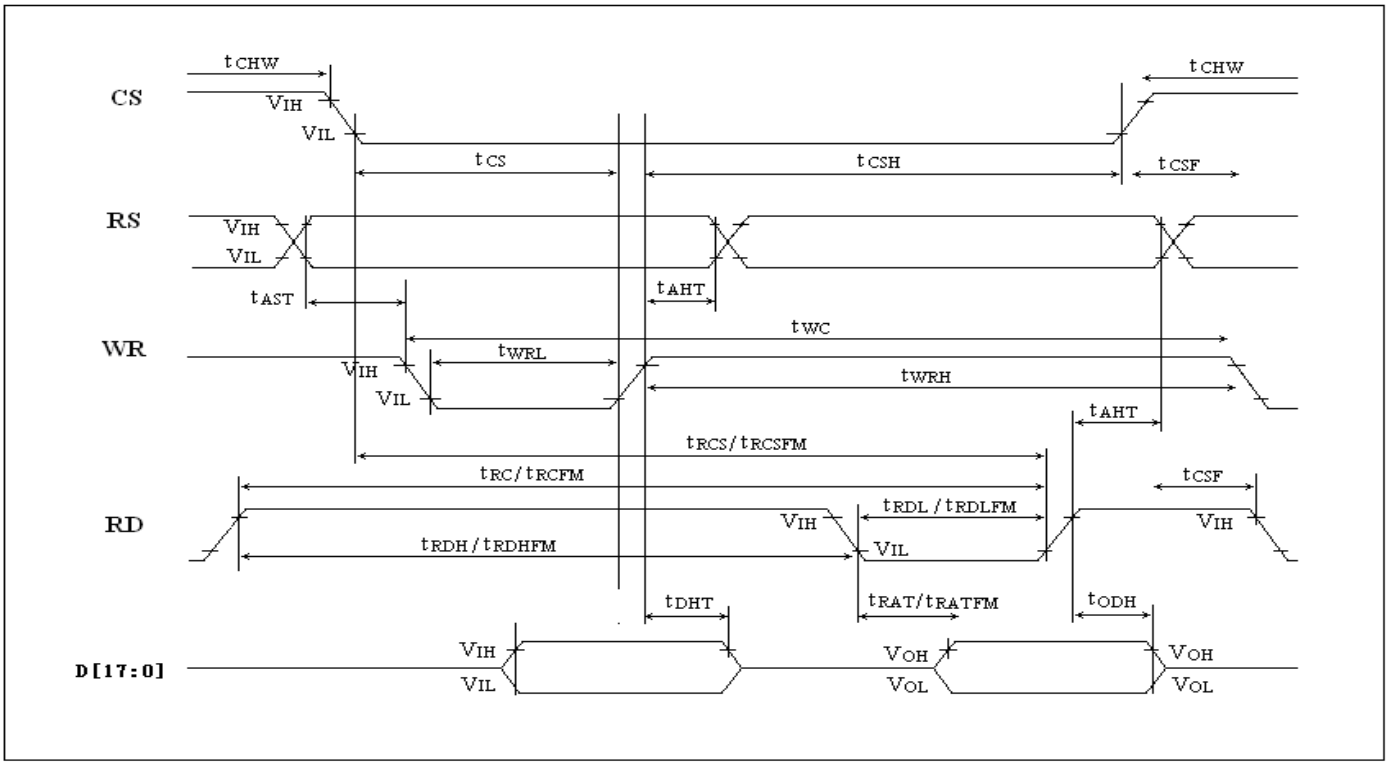


Figure 1.1 CPU Interface Characteristics

1.2 Interface Timing Parameters

Normal Write Mode

Signal	Symbol	Parameter	Spec.			Description
			Min.	Max.	Unit	
RS	t_{AST} t_{AHT}	Address setup time Address hold time(Write/Read)	10 10	-	ns	-
CS	t_{CHW} t_{CS} t_{RCSFM} t_{CSF} t_{CSH}	Chip select “H” pulse width Chip select setup time (Write) Chip select setup time (Read FM) Chip select wait time(Write/Read) Chip select hold time	0 35 355 10	-	ns	-
WR	t_{WC} t_{WRH} t_{WRL}	Write cycle Control pulse “H” duration Control pulse “L” duration	100 15 15	-	ns	-
RD	t_{RC} t_{RDH} t_{RDL}	Read cycle (ID) Control pulse “H” duration (ID) Control pulse “L” duration (ID)	450 90 355	-	ns	When read from GRAM
D[17:0]	t_{DST} t_{DHT} t_{RATFM} t_{ODH}	Data setup time Data hold time Read access time (FM) Output disable time	15 10 - 20(4)	- - 340(4) 80(4)	ns	For maximum C_L=30pF For minimum C_L=8pF

Tabel 1.2 CPU Interface Timing Parameters

1.3 Interface Register Write/Read Timing

1.3.1 System Bus Interface Register Write Timing

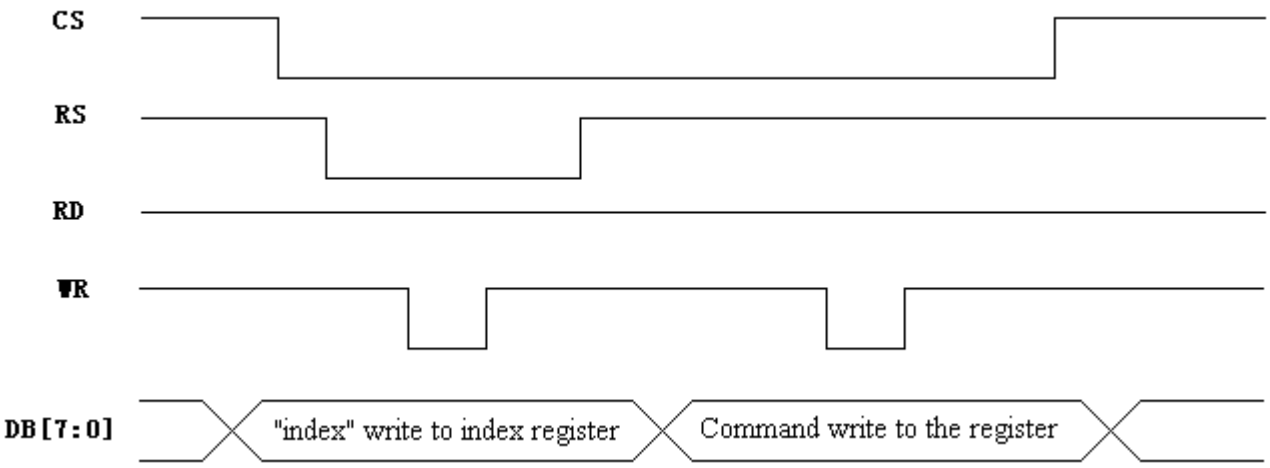


Figure 1.3.1 System Bus Interface Write Register Timing

1.3.2 System Bus Interface Register Read Timing

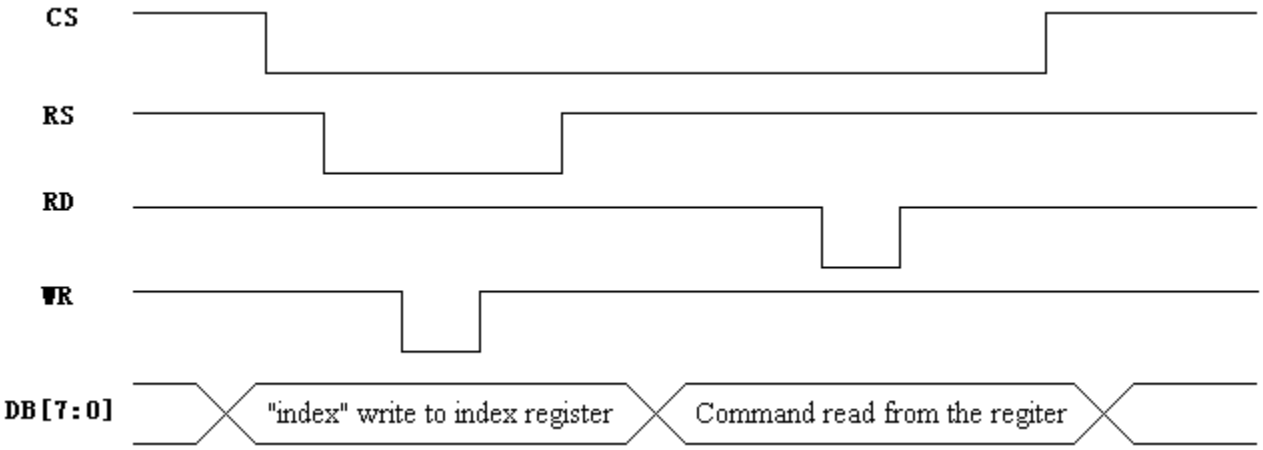


Figure 1.3.2 System Bus Interface Read Register Timing

1.4 GRAM Write/Read Data Format

1.4.1 18-bit Read/Write GRAM Data Format(262K)

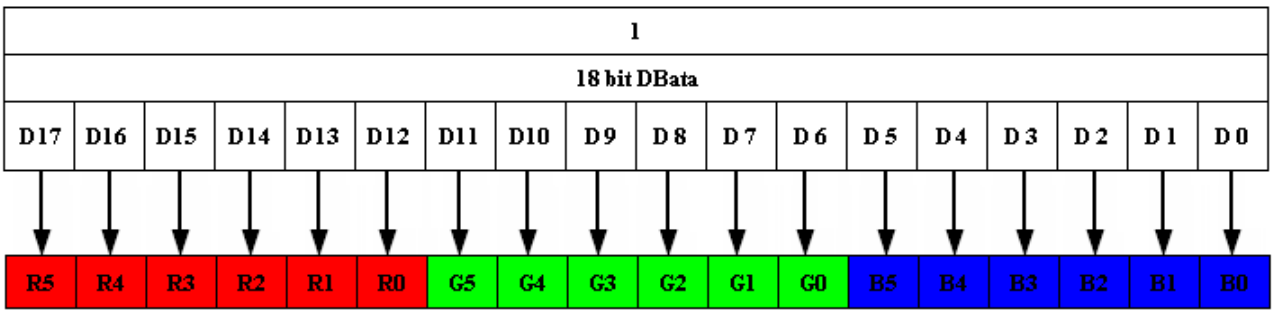


Figure 1.4.1 18-bit Data Bus GRAM Write/Read Data Format(262K)

1.4.2 16-bit Read/Write RGAM Data Format(262K/65K)

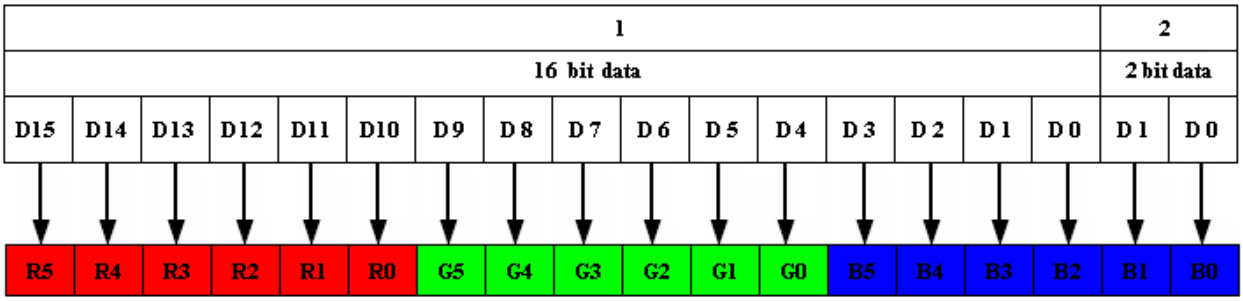


Figure 1.4.2.1 16-bit Data Bus GRAM Write/Read Data Format(16+2bit,262K)

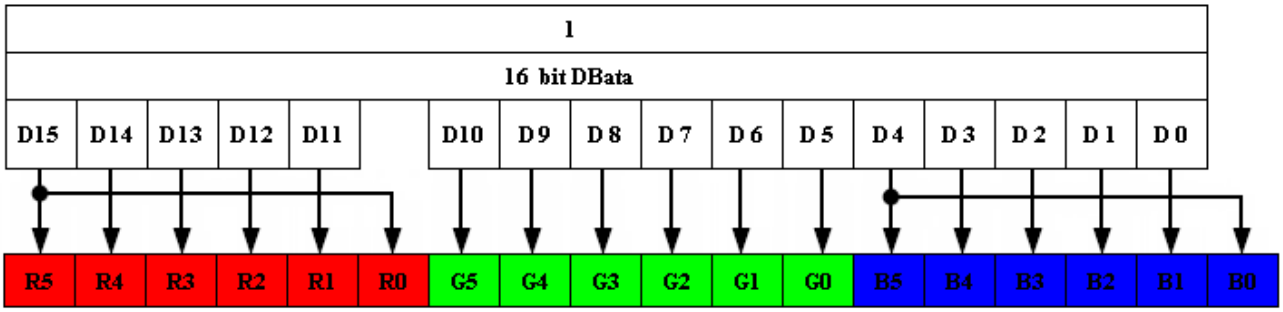


Figure 1.4.2.2 16-bit Data Bus GRAM Write/Read Data Format(16bit,65K)

1.4.3 8-bit Read/Write RGAM Data Format(262K)

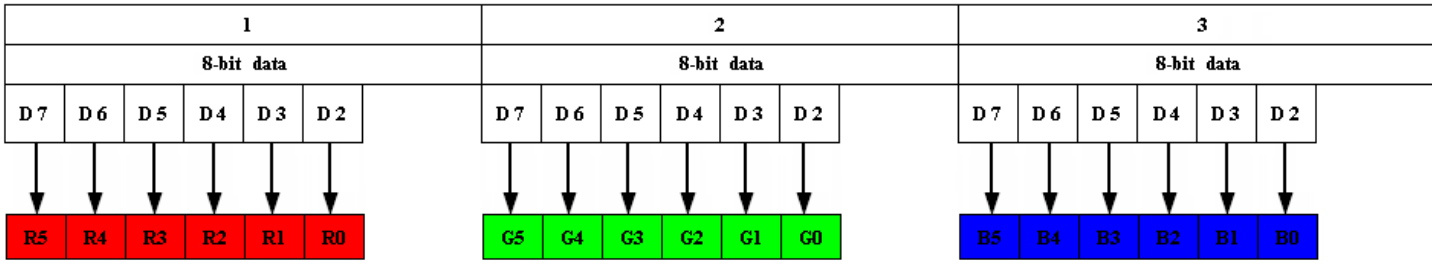


Figure 1.4.3.1 18-bit Data Bus GRAM Write/Read Data Format(8bit,262K)

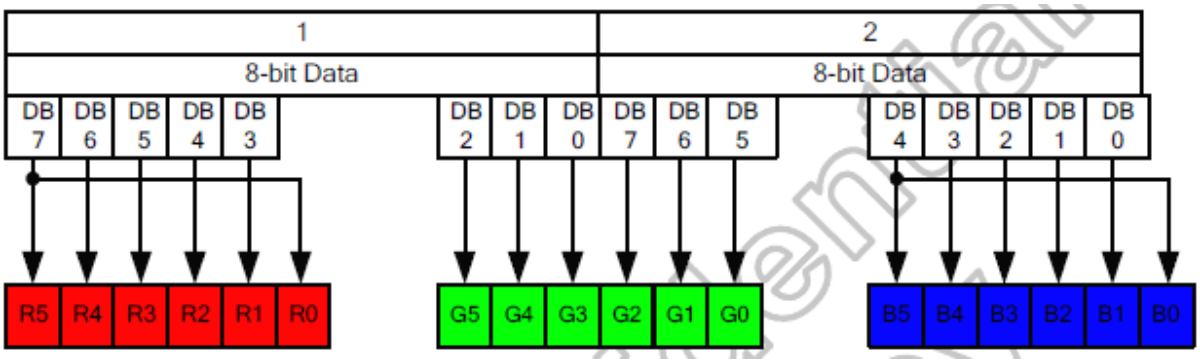


Figure 1.4.3.2 8-bit Data Bus GRAM Write/Read Data Format(8bit,65K)

1.5 Data Bus GRAM Write/Read Timing

1.5.1 18-bit Data Bus GRAM Write/Read Timing(262K)

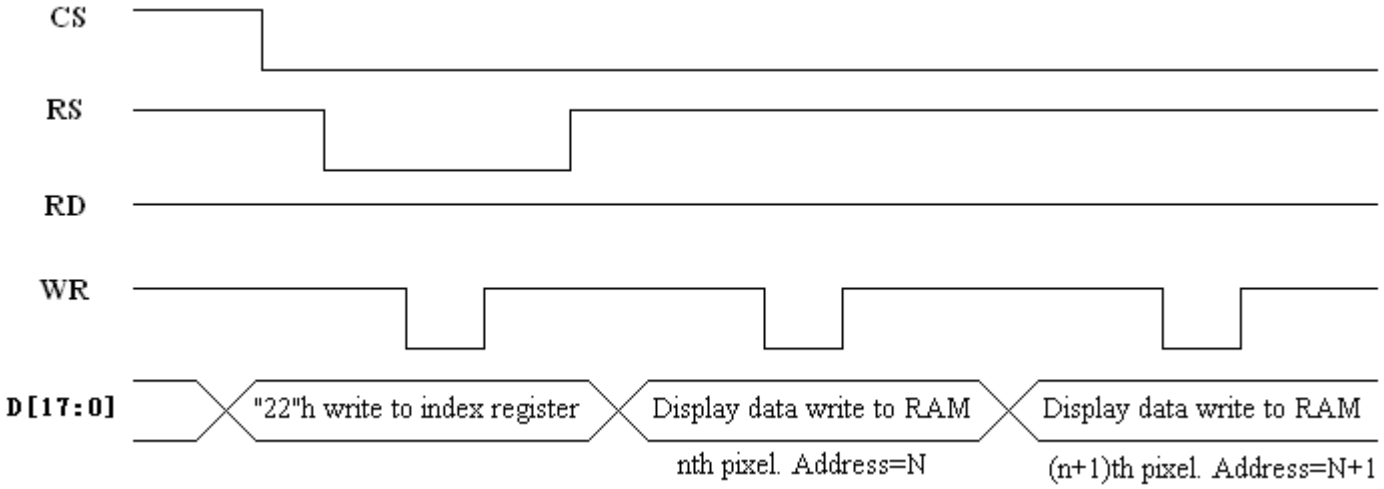


Figure 1.5.1.1 18-bit Data Bus GRAM Write Timing(262K)

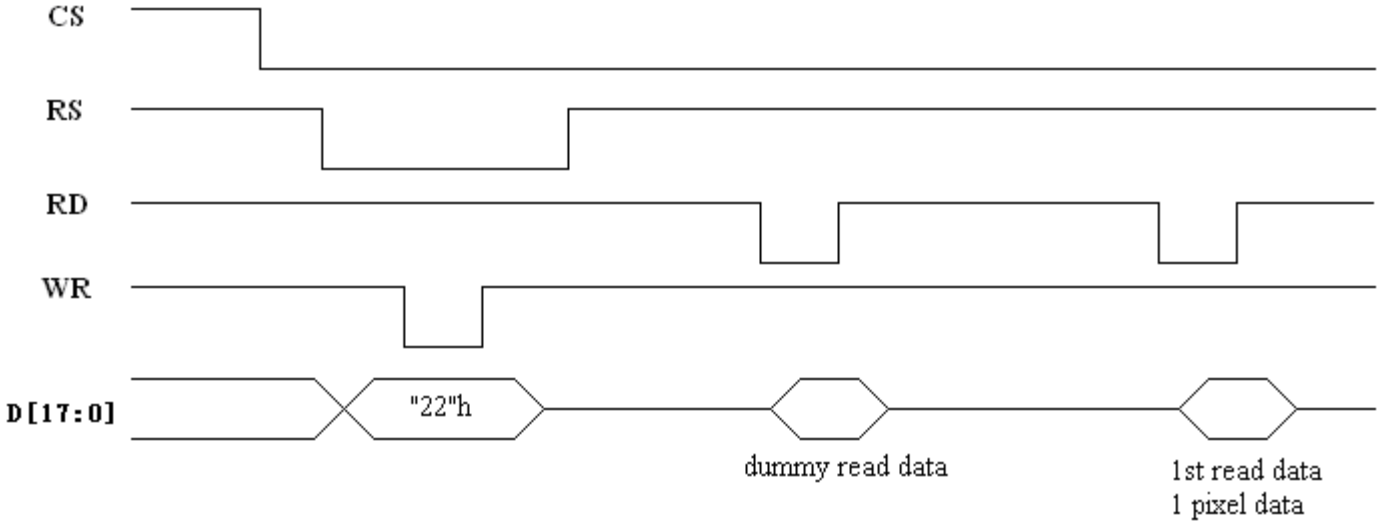


Figure 1.5.1.2 18-bit Data Bus GRAM Read Timing(262K)

1.5.2 16-bit Data Bus GRAM Write/Read Timing(262K/65K)

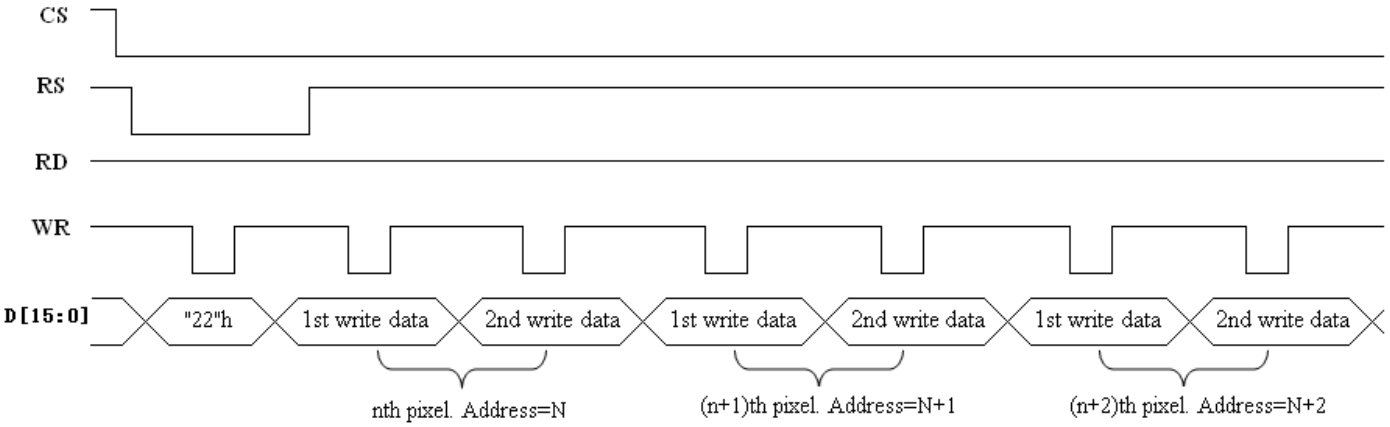


Figure 1.5.2.1 16-bit Data Bus GRAM Write Timing(16+2bit,262K)

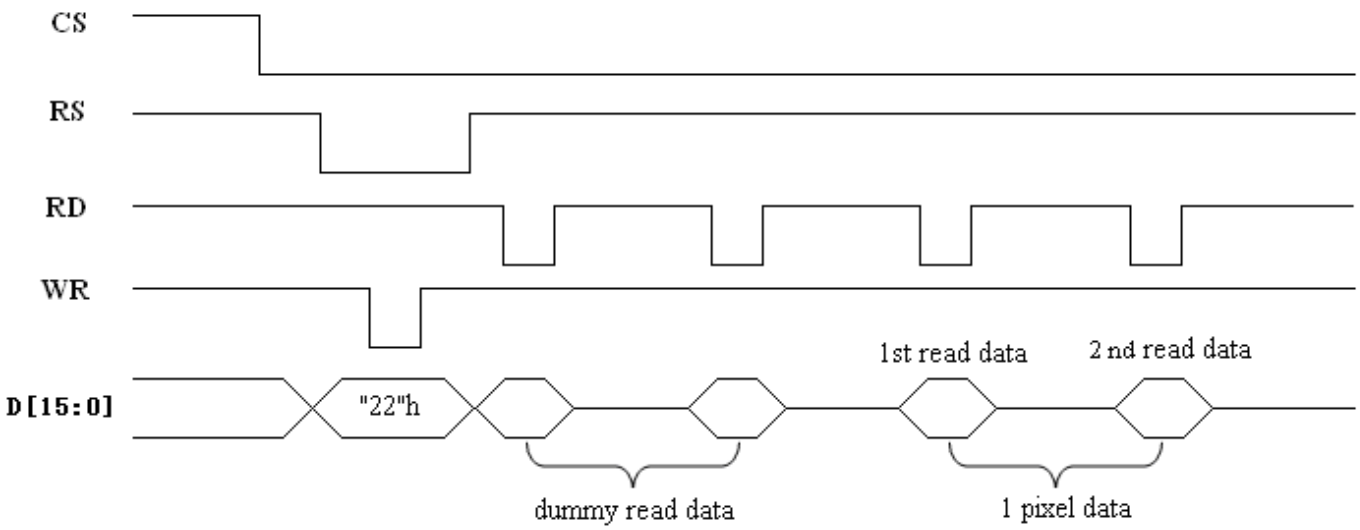


Figure 1.5.2.2 16-bit Data Bus GRAM Read Timing(16+2bit,262K)

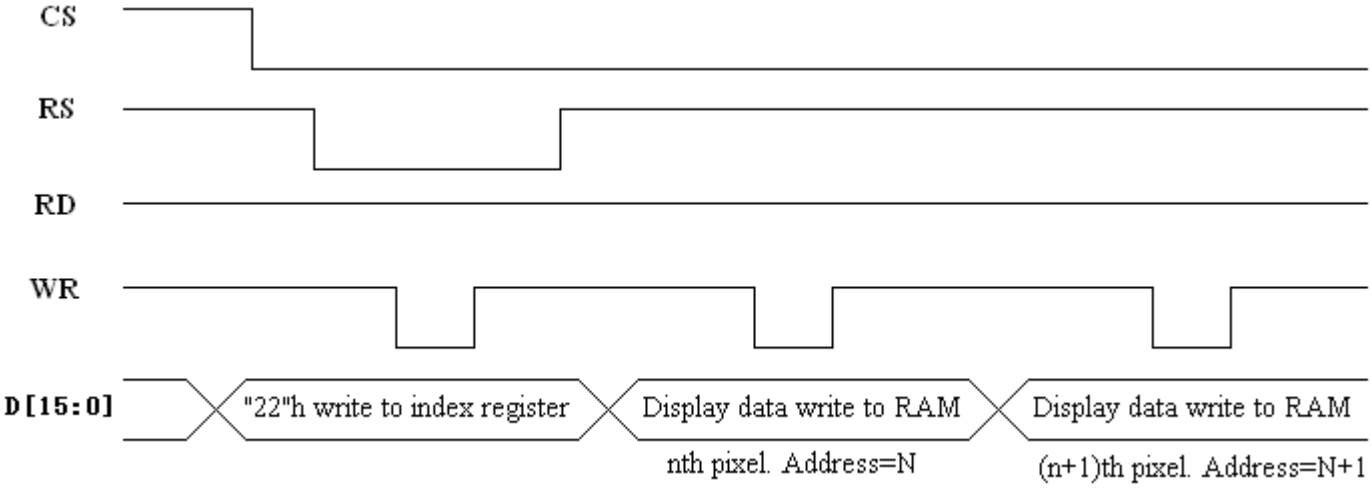


Figure 1.5.2.3 16-bit Data Bus GRAM Write Timing(16bit,65K)

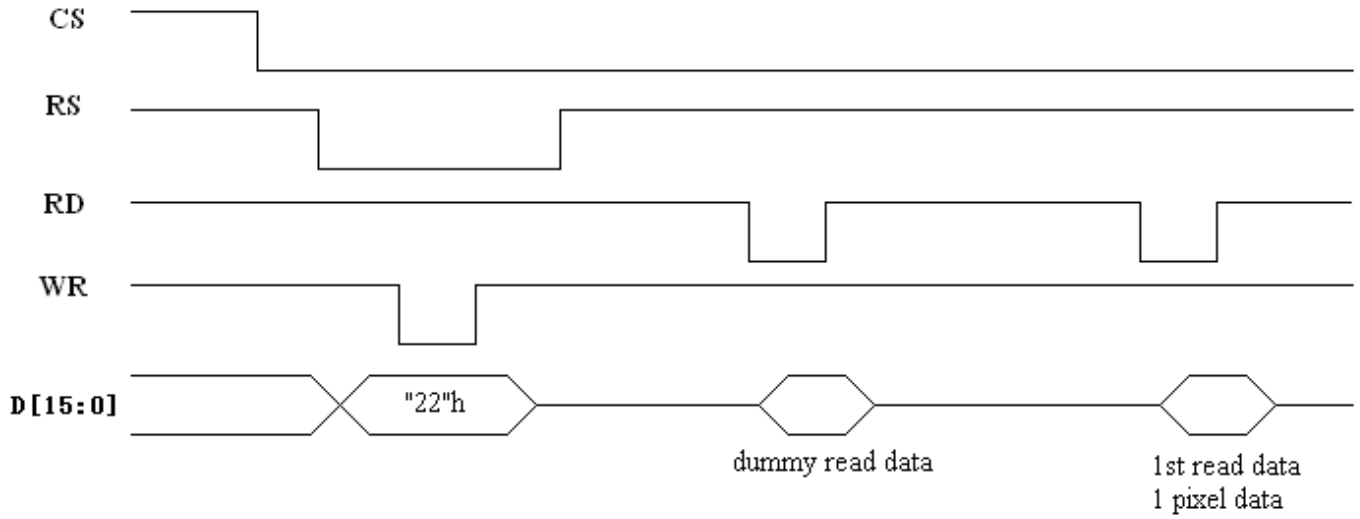


Figure 1.5.2.4 16-bit Data Bus GRAM Read Timing(16bit,65K)

1.5.3 8-bit Data Bus GRAM Write/Read Timing(262K)

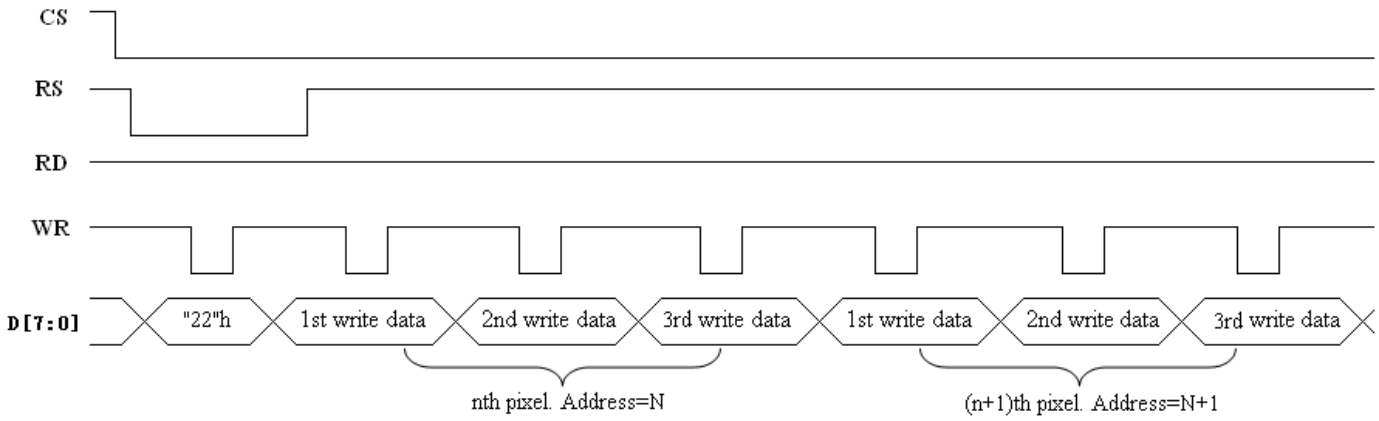


Figure 1.5.3.1 8-bit Data Bus GRAM Write Timing(6+6+6bit,262K)

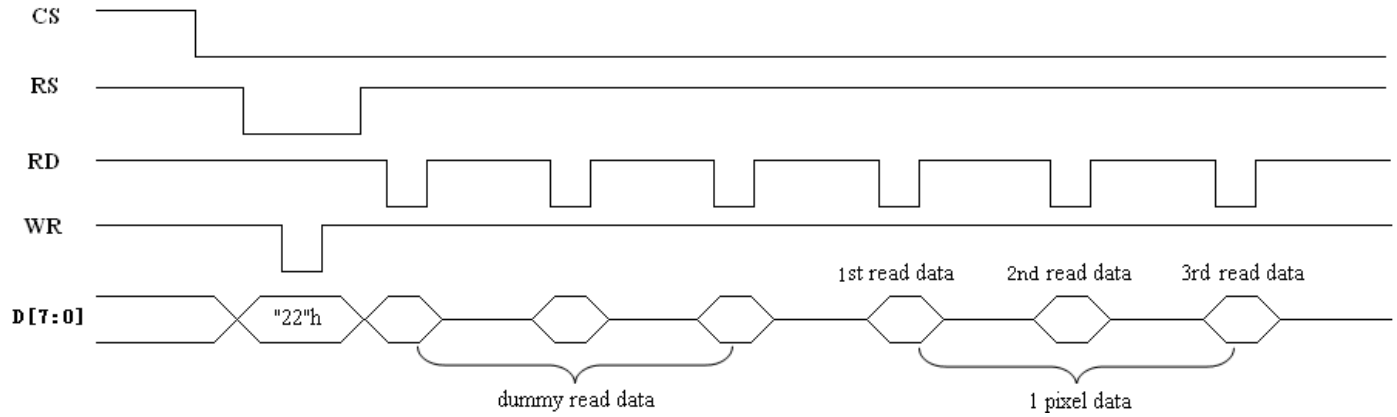


Figure 1.5.3.2 8-bit Data Bus GRAM Read Timing(6+6+6bit,262K)

2. SPI Interface

2.1 SPI Timing Parameter

Parameter	Symbol	Conditions	Spec.			Unit
			Min.	Typ.	Max.	
Serial clock cycle (Write)	t_{SCYCW}	DNC_SCL	100	-	-	ns
DNC _SCL "H" pulse width (Write)	t_{SHW}		35	-	-	
DNC _SCL "L" pulse width (Write)	t_{SLW}		35	-	-	
Data setup time (Write)	t_{SDS}	SDI	30	-	-	ns
Data hold time (Write)	t_{SDH}		30	-	-	
Serial clock cycle (Read)	t_{SCYCR}	DNC _SCL	150	-	-	ns
DNC _SCL "H" pulse width (Read)	t_{SHR}		60	-	-	
DNC _SCL "L" pulse width (Read)	t_{SLR}		60	-	-	
Access Time	t_{ACC}	SDA for maximum C_L=30pF For minimum C_L=8pF	15	-	100	ns
Output disable time	t_{OH}	SDO For maximum C_L=30pF For minimum C_L=8pF	15(3)	-	100(3)	ns
DNC _SCL to Chip select	t_{SCC}	DNC _SCL, NCS	15(3)	-	-	ns
NCS "H" pulse width	t_{CHW}	NCS	45	-	-	ns
Chip select setup time	t_{CSS}	NCS	60	-	-	ns
Chip select hold time	t_{CSH}		65	-	-	

Table 2.1.1 SPI Interface Timing Parameters

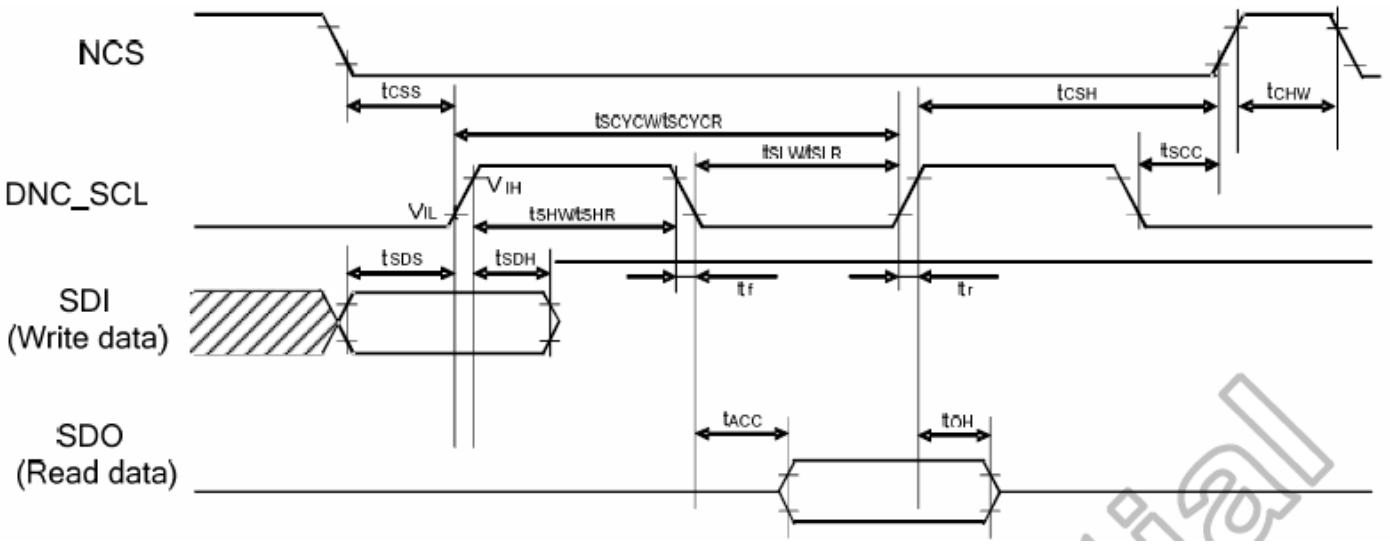


Figure 2.1.1 SPI Interface Timing

2.2 Signals Timing Chart

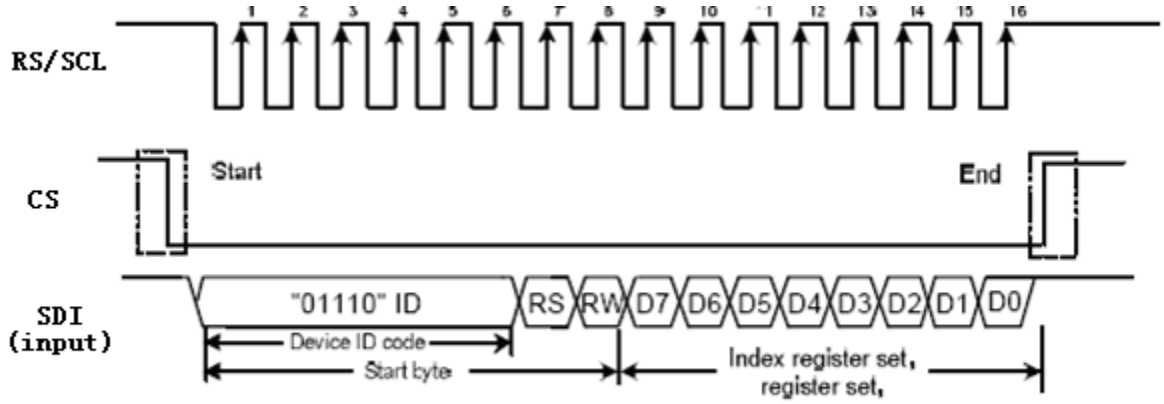


Figure 2.2.1 Write Timing Chart in SPI Interface

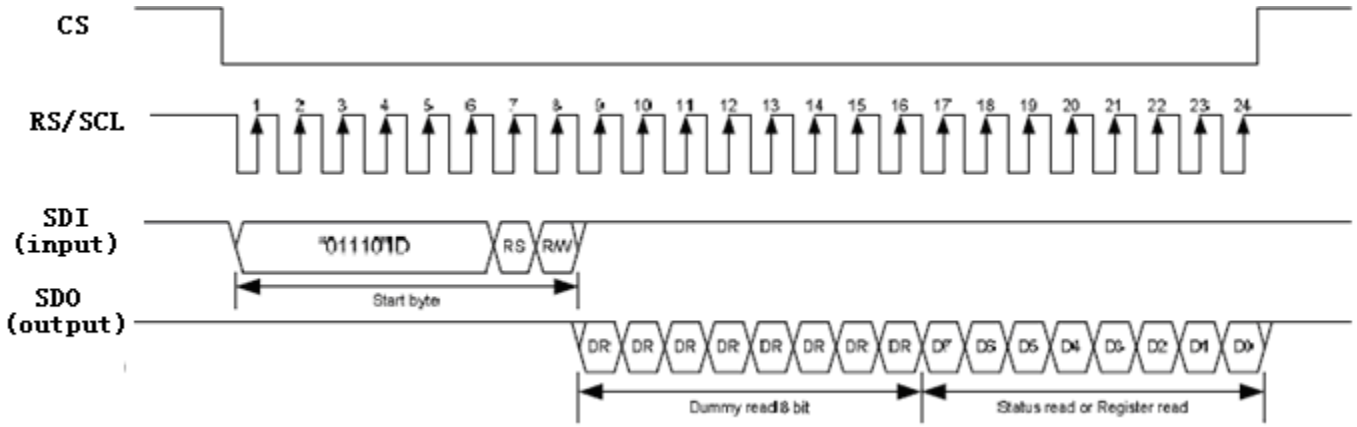


Figure 2.2.2 Read Timing Chart in SPI Interface

3. RGB Interface

3.1 RGB Timing Parameter

Symbol	Parameter	Conditions	Related Pins	Spec.			Unit
				Min.	Typ.	Max.	
t_{DCYC}	PCLK cycle time	VRR = Min . 50 Hz Max. 65 Hz	PCLK	77(2,5)	-	226(3)	ns
				33(4,6)		77(2,6)	
t_{DLW} t_{CHW}	PCLK Low time PCLK High time	-		15 15	- -	- -	ns
t_{DDS} t_{DDH}	RGB Data setup time RGB Data hold time	-	PCLK, DB17-DB0	15 15	- -	- -	ns
t_{DCSS} t_{DCSH}	DE setup time DE hold Time	-	DE	15 15	-	-	ns
t_{DSYN}	SYNC setup time	-	PCLK, HS, VS	15	-	-	ns

Table 3.1.1 18bit RGB Interface Timing Parameters

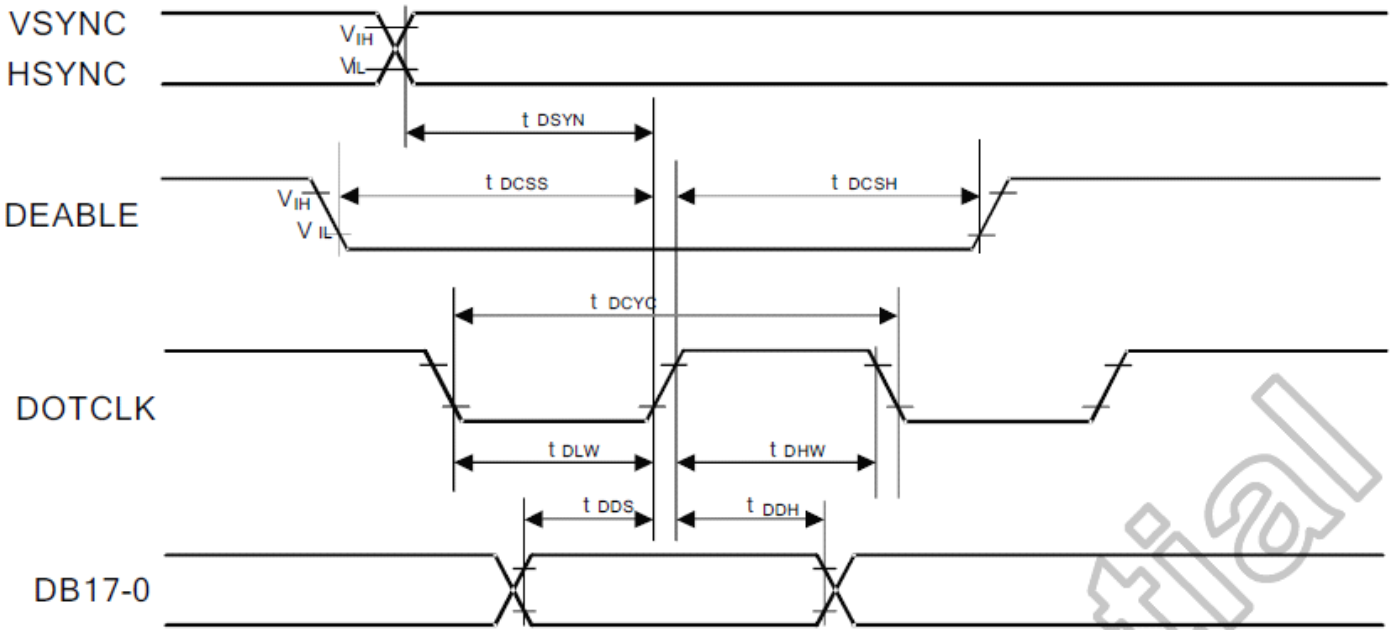


Figure 3.1.1 RGB Interface Timing

3.2 Signals Timing Chart

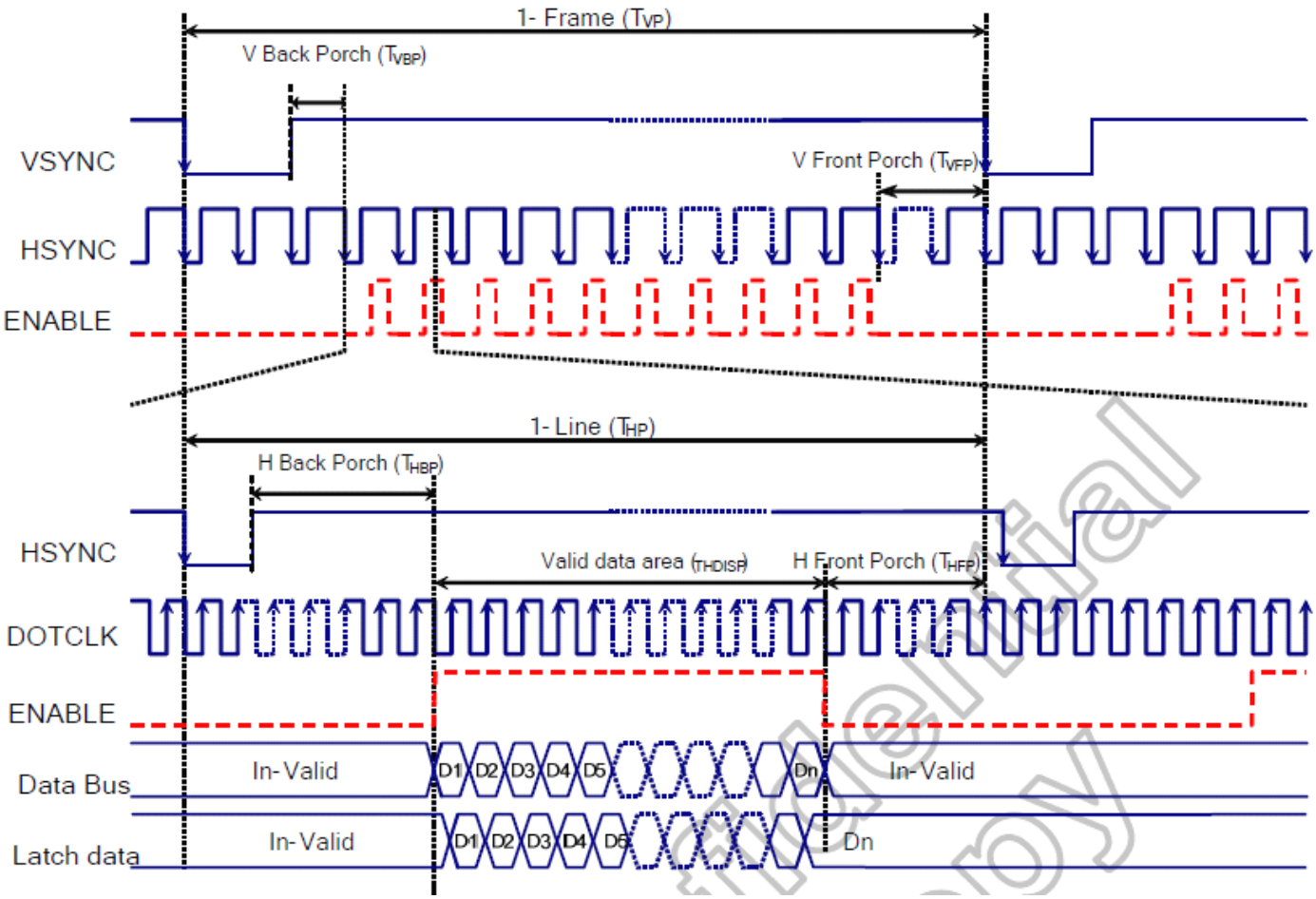


Figure 3.2.1 Write Timing Chart in RGB Interface

4. Reset Timing Characteristics

IOVCC=1.65~3.3V, VCC=2.3~3.3V.

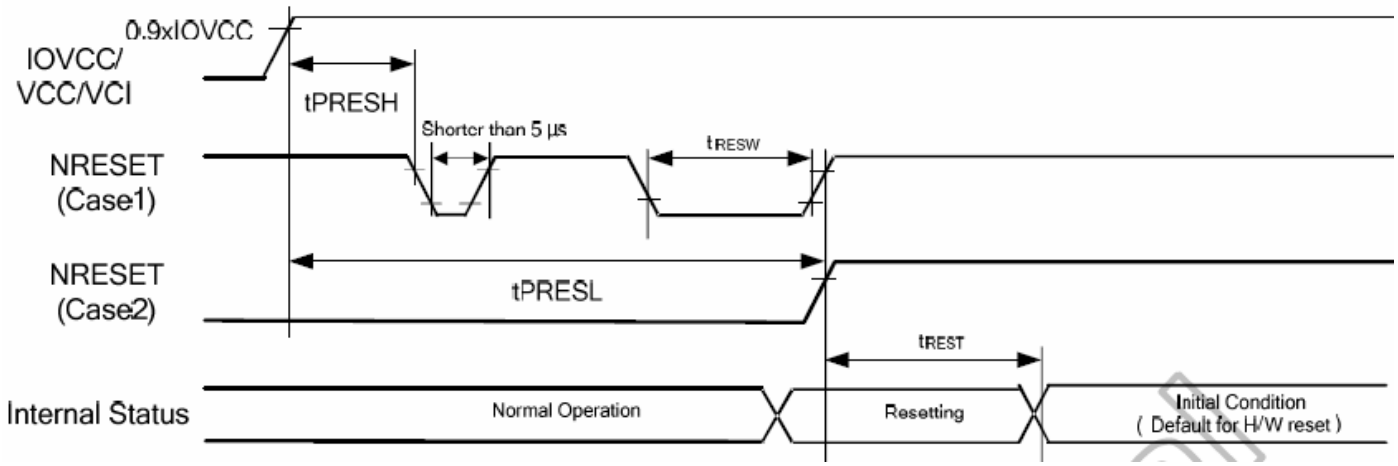


Figure 4.1 Reset Input Timing

Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
tRESW	Reset low pulse width	RESET	10	-	-	-	us
tREST	Reset complete time	-	-	-	10	When reset applied during STB mode	ms
		-		-	120	When reset applied during STB mode	ms
tPRESH	Reset goes high level after Power on time	NRESET & IOVCC	1	-	-	Reset goes high level after Power on	ms
tPRESL	Reset goes low level in Power on time	NRESET & IOVCC	5	-	-	Reset goes low level in Power on	ms

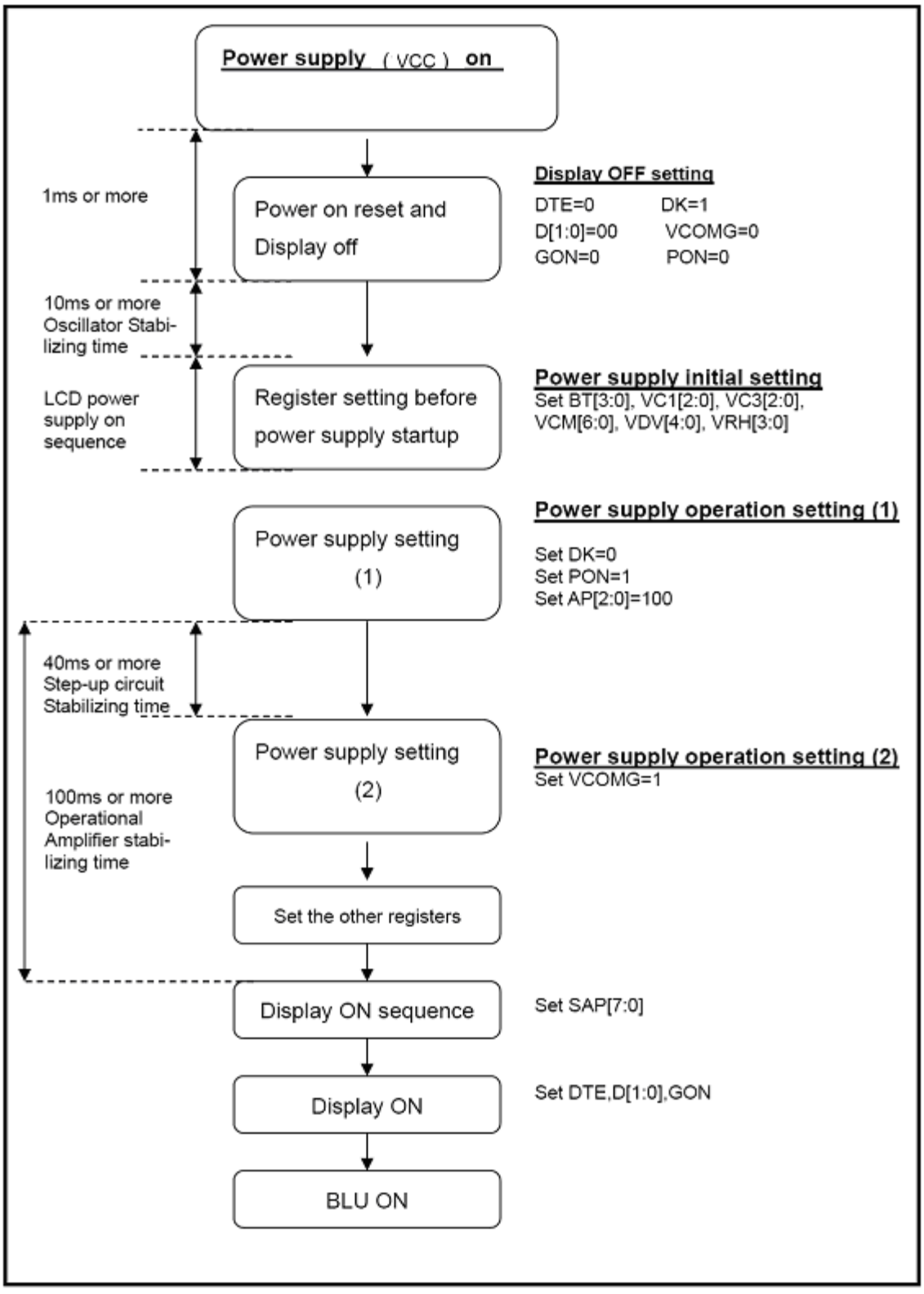
Table 4.1 Reset Timing Parameters

Note 3:

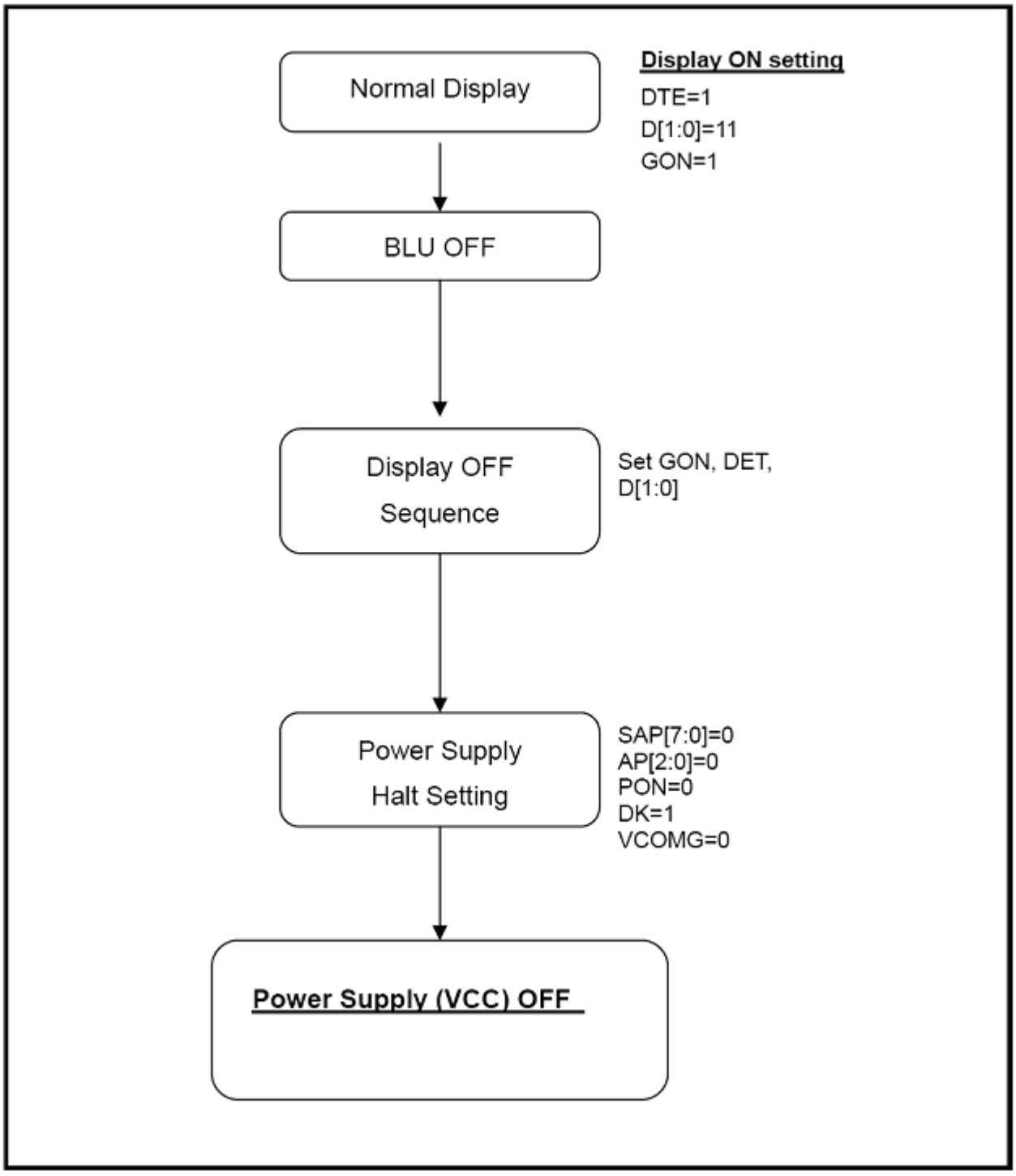
RESET Pulse	Action
Shorter than 5µs	Shorter than 5µs
Longer than 10µs	Reset
Between 5µs and 10µs	Reset Start

5. Power On/Off Sequence

5.1 Power on Sequence



5.2 Power off Sequence



■ RELIABILITY TEST

No.	Test Item	Test Condition	Remark
1	High Temperature Storage	80±2℃/240 hours	IEC60068-2-1 GB2423.2
2	Low Temperature Storage	-30±2℃/240 hours	IEC60068-2-1 GB2423.1
3	High Temperature Operating	70±2℃/240 hours	IEC60068-2-1 GB2423.2
4	Low Temperature Operating	-20±2℃/240 hours	IEC60068-2-1 GB2423.1
5	Temperature Cycle storage	-30±2℃~25~80±2℃×20cycles (30min.) (5min.) (30min.)	Start with cold temperature, with high temperature, IEC60068-2-14 GB2423.22
6	Damp proof Test operating	60℃±5℃×90%RH/240 hours	IEC60068-2-78 GB/T2423.3
7	Vibration Test (non-operation)	Frequency range:10Hz~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2hours for each direction of X,Y,Z(6 hours for total)	IEC60068-2-6 GB/T2423.10
8	Package drop test	Height:80 cm,1 corner,3 edges,6 surfaces	IEC60068-2-32,GB2423.8
9	ESD test (operation)	C=150pF,R=330Ω,5points/panel Air: ±8KV,5times Contact: ±4KV,5times(Environment: 15℃~35℃,30%~60%,86Kpa~106Kpa)	IEC61000-4-2 GB/T17626.2
10	Shock(non-operation)	60G 6ms,±X,±Y,±Z 3times each direction	IEC60068-2-27 GB/T2423.5

Note 1:Ts is the temperature of panel's surface.
Note 2:Ta is the ambient temperature of sample.

■ INSPECTION CRITERION

This specification is made to be used as the standard acceptance/rejection criteria for Normal LCM Product.

1 Sample plan

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

Major defect: AQL 0.65

Minor defect: AQL 1.5

2. Inspection condition

●Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45 ° against perpendicular line. (Normal temperature 20~25°C and normal humidity 60±15%RH).

● Driving voltage

The Vop value from which the most optimal contrast can be obtained near the specified Vop in the specification (Within ±0.5V of the typical value at 25°C.).

3. Definition of inspection zone in LCD.

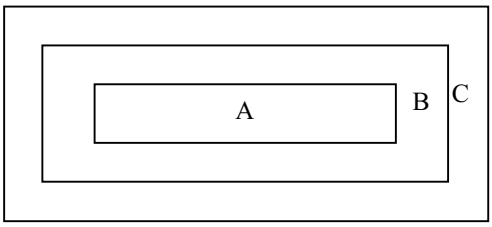


Fig.4

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.4 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.

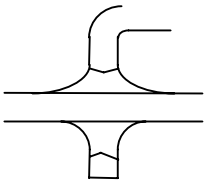
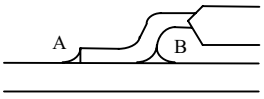
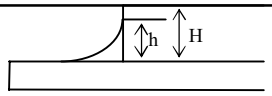
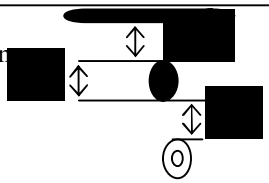
4.Inspection Standard

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

4.2.1 Module Cosmetic Criteria

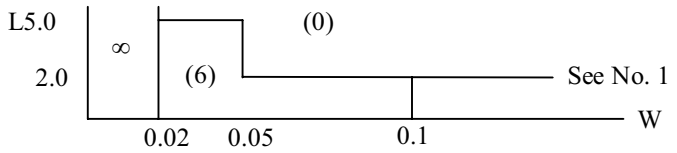
No.	Item	Judgement Criterion	Partition
1	Difference in Spec.	None allowed	Major
2	Pattern peeling	No substrate pattern peeling and floating	Major
3	Soldering defects	No soldering missing No soldering bridge No cold soldering	Major Major Minor
4	Resist flaw on Printed Circuit Boards	visible copper foil (∅0.5mm or more) on substrate pattern	Minor
5	Accretion of metallic Foreign matter	No accretion of metallic foreign matters (Not exceed ∅0.2mm)	Minor Minor
6	Stain	No stain to spoil cosmetic badly	Minor
7	Plate discoloring	No plate fading, rusting and discoloring	Minor
8	Solder amount 1. Lead parts	a. Soldering side of PCB Solder to form a 'Filet' all around the lead. Solder should not hide the lead form perfectly. (too much) b. Components side (In case of 'Through Hole PCB') Solder to reach the Components side of PCB. 	Minor
	2. Flat packages	Either 'Toe' (A) or 'Seal' (B) of the lead to be covered by 'Filet'. Lead form to be assume over solder. 	Minor
	3. Chips	(3/2) H ≥ h ≥ (1/2) H 	Minor
9	Solder ball/Solder splash	a. The spacing between solder ball and the conductor or solder pad h ≥0.13mm The diameter of solder ball d ≤0.15mm.  b. The quantity of solder balls or solder Splashes isn't beyond 5 in 600 mm^2 . c. Solder balls/Solder splashes do not violate minimum electrical clearance.	Minor Minor Major

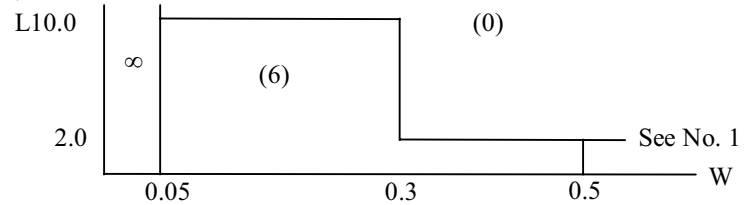
		d. Solder balls/Solder splashes must be entrapped/encapsulated Or attached to the metal surface . NOTE: Entrapped/encapsulated/attached is intended to mean that normal service environment of the product will not cause a solder ball to become dislodged.	Minor

4.2.2Cosmetic Criteria (Non-Operating)

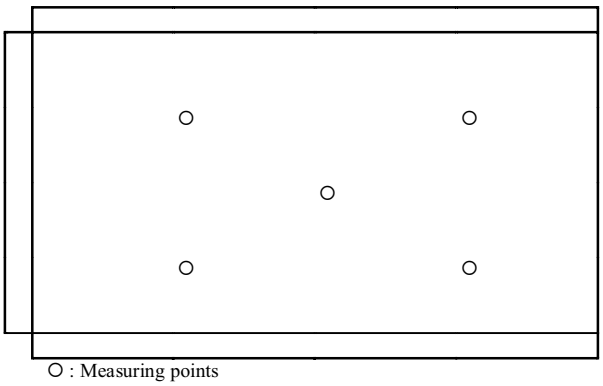
No.	Defect	Judgment Criterion	Partition
1	Spots	In accordance with *Screen Cosmetic Criteria (Operating) No.1.*	Minor
2	Lines	In accordance with *Screen Cosmetic Criteria (Operating) No.2.*	Minor
3	Bubbles in polarizer	Size : d mm / Acceptable Qty in active area $d \le 0.3$: Disregard $0.3 < d \le 1.0$: 3 $1.0 < d \le 1.5$: 1 $1.5 < d$: 0	Minor
4	Scratch	In accordance with spots and lines operating cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable.	Minor
5	Allowable density	Above defects should be separated more than 30mm each other.	Minor
6	Coloration	Not to be noticeable coloration in the viewing area of the LCD panels. Back-lit type should be judged with back-lit on state only.	Minor
7	Contamination	Not to be noticeable.	Minor

4. 2. 3 Cosmetic Criteria (Operating)

<table>
<tr><th>No.</th><th>Defect</th><th>Judgment Criterion</th><th>Partition</th></tr>
<tr><td>1</td><td>Spots</td><td>A) Clear
<table>
<tr><th>Lcd size</th><th>Size : d mm</th><th>Acceptable Qty in active area</th></tr>
<tr><td rowspan="4">Lcd size≤ 8.0'</td><td>d≤0.1</td><td>Disregard</td></tr>
<tr><td>0.1＜d≤0.2</td><td>6</td></tr>
<tr><td>0.2＜d≤0.3</td><td>2</td></tr>
<tr><td>0.3 ＜ d</td><td>0</td></tr>
<tr><td rowspan="4">Lcd size＞8.0'</td><td>d ≤0.1</td><td>Disregard</td></tr>
<tr><td>0.1＜d≤0.3</td><td>10</td></tr>
<tr><td>0.3＜d≤0.5</td><td>5</td></tr>
<tr><td>0.5 ＜ d</td><td>0</td></tr>
</table>
Note : Including pin holes and defective dots which must be within one pixel size; Total defective point shall not exceed 6 pcs no more than 8 inch LCD and 10PCS for more than 8 inch LCD.
B) Unclear
<table>
<tr><th>Lcd size</th><th>Size : d mm</th><th>Acceptable Qty in active area</th></tr>
<tr><td rowspan="4">Lcd size≤ 8.0'</td><td>d≤0.2</td><td>Disregard</td></tr>
<tr><td>0.2＜d≤0.5</td><td>6</td></tr>
<tr><td>0.5＜d≤0.7</td><td>2</td></tr>
<tr><td>0.7＜d</td><td>0</td></tr>
<tr><td rowspan="5">Lcd size ＞8.0'</td><td>d≤0.2</td><td>Disregard</td></tr>
<tr><td>0.2＜d≤0.5</td><td>10</td></tr>
<tr><td>0.5＜d≤0.7</td><td>3</td></tr>
<tr><td>0.7＜d≤1.0</td><td>1</td></tr>
<tr><td>1.0＜ d</td><td>0</td></tr>
</table>
Note : Total defective point shall not exceed 6 pcs for no more than 8 inch LCD and 10PCS for more than 8 inch LCD.</td><td>Minor</td></tr>
<tr><td>2</td><td>Lines</td><td>A) Clear


Note : ( ) - Acceptable Qty in active area
L - Length (mm)
W - Width (mm)
∞ - Disregard
B) Unclear


'Clear' = The shade and size are not changed by V_{op}.
'Unclear' = The shade and size are changed by V_{op}.</td><td>Minor</td></tr>
</table>

3	Rubbing line	Not to be noticeable.	Minor
4	Allowable density	Above defects should be separated more than 10mm each other.	Minor
5	Rainbow	Not to be noticeable.	Minor
6	Dot size	To be 95% ~ 105% of the dot size (Typ.) in drawing. Partial defects of each dot (ex. pin-hole) should be treated as 'Spot'. (see *Screen Cosmetic Criteria (Operating) No.1*)	Minor
7	Uneven brightness (only back-lit type module)	Uneven brightness must be BMAX / BMIN ≤ 2 - BMAX : Max. value by measure in 5 points - BMIN : Min. value by measure in 5 points Divide active area into 4 vertically and horizontally. Measure 5 points shown in the following figure.  O : Measuring points	Minor

Note :

(1) Size : d = (long length + short length) / 2

(2) The limit samples for each item have priority.

(3) Complex defects are defined item by item, but if the numbers of defects are defined in above table, the total number should not exceed 10.

(4) In case of 'concentration', even the spots or the lines of 'disregarded' size should not allowed. Following three situations should be treated as 'concentration'.

- 7 or over defects in circle of ∅5mm.
- 10 or over defects in circle of ∅10mm.
- 20 or over defects in circle of ∅20mm.

■ 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.

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.

(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the 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.

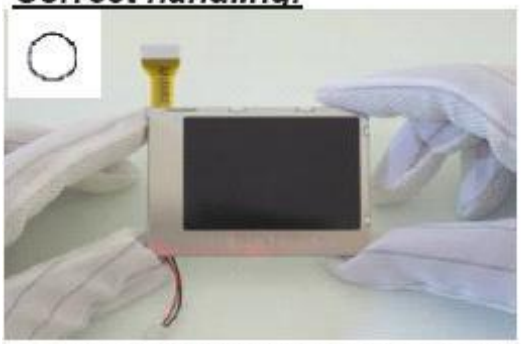
To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

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

Handling precaution for LCM

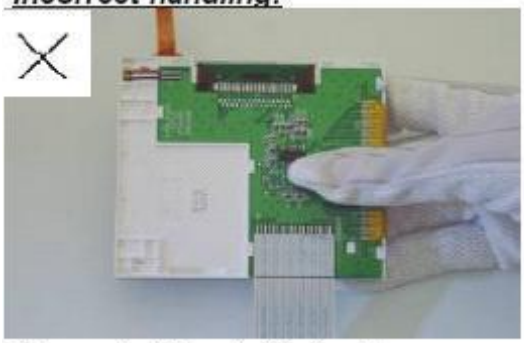
LCM is easy to be damaged.
Please note below and be careful for handling!

Correct handling:

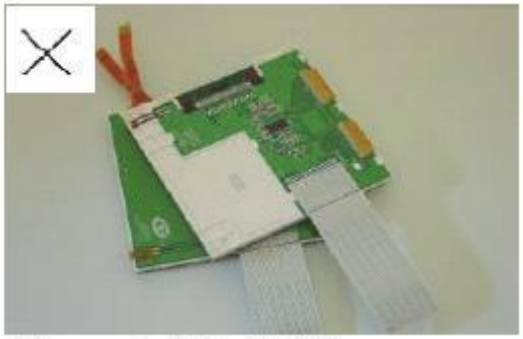


As above picture, please handle with anti-static gloves around LCM edges.

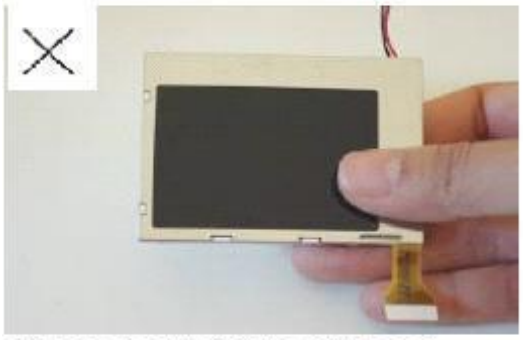
Incorrect handling:



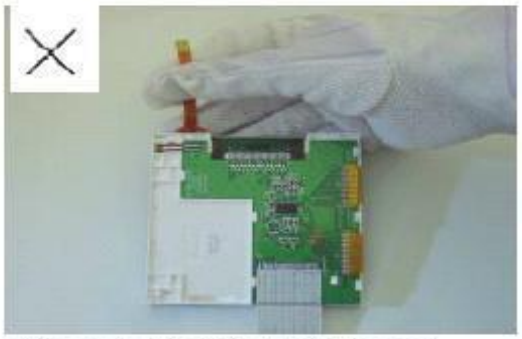
Please don't touch IC directly.



Please don't stack LCM.



Please don't hold the surface of panel.

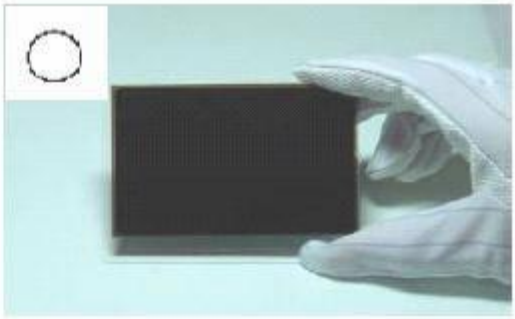


Please don't stretch interface of output, such as FPC cable.

Handling precaution for LCD

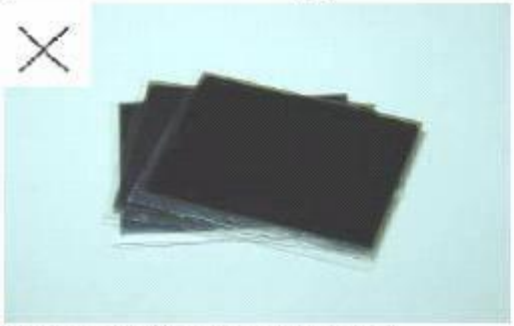
LCD is easy to be damaged.
Please note below and be careful for handling!

Correct handling:



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

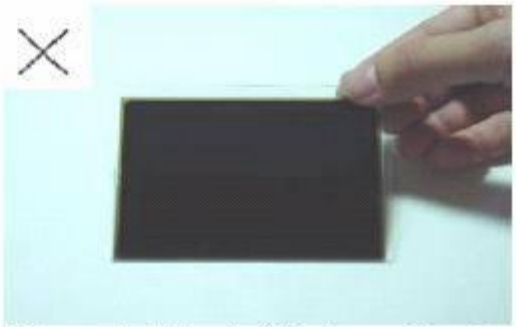
Incorrect handling:



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.

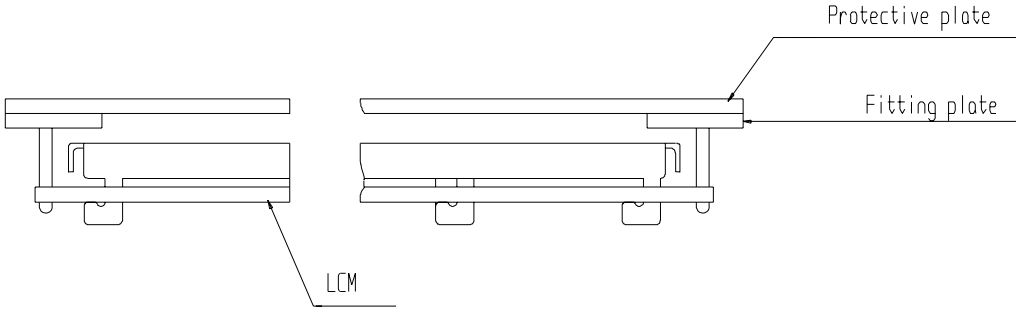
- Exposed area of the printed circuit board.
-Terminal electrode sections.

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.

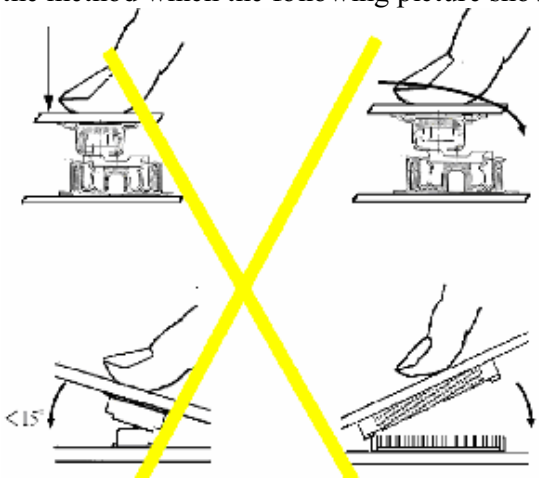
(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.

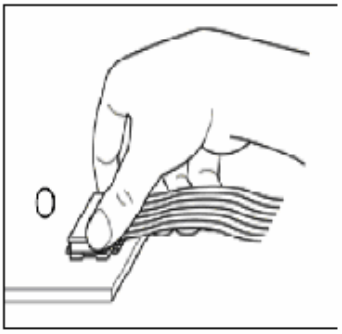


(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

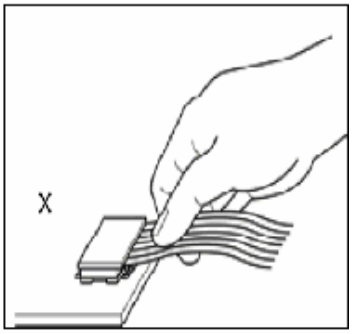
Precaution for assemble the module with BTB connector:

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





OK



NG

Precaution for soldering to the LCM

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

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

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

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

Precautions for Operation

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

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

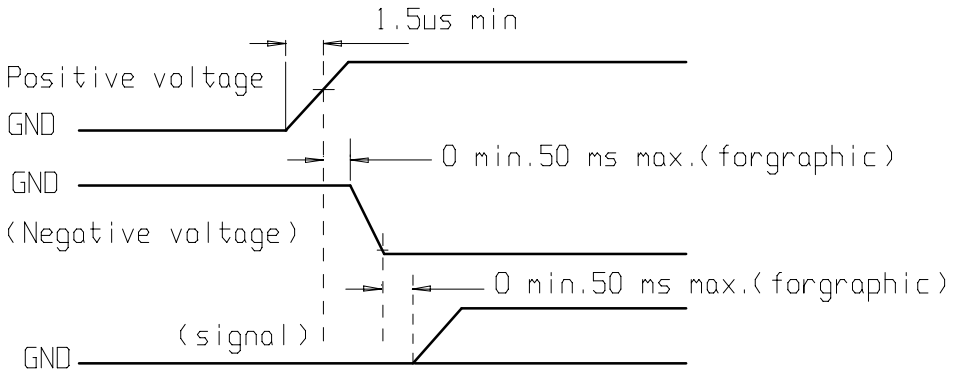
(3) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, Which will come back in the specified operating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

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

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

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

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



Safety

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

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

Limited Warranty

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