



**CLOVER DISPLAY LTD.**

## LCD MODULE SPECIFICATION

**Model: CG12864A - \_ \_ \_ - \_ \_ \_ - \_ \_**

Revision	02
Engineering	Timmy Kwan
Date	18 July 2011
Our Reference	X9040

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**MODE OF DISPLAY****Display mode**

- STN :  Yellow green  
 Grey  
 Blue (negative)  
 FSTN positive  
 FSTN negative

**Display condition**

- Reflective type  
 Transflective type  
 Transmissive type  
 Others

**Viewing direction**

- 6 O' clock  
 12 O' clock  
 3 O' clock  
 9 O' clock

**LCD MODULE NUMBER NOTATION:**

CG12864A - N N - S R - N 6 - T

| | | | | | |  
(1) (2) (3) (4) (5) (6) (7) (8)

\*(1)---Model number of standard LCD Modules

\*(2)---Backlight type

- N – No backlight  
E – EL backlight  
L – Side-lited LED backlight  
M– Array LED backlight  
C – CCFL

\*(3)---Backlight color

- N – No backlight  
A – Amber  
B – Blue  
O– Orange  
W–White  
Y – Yellow green  
M – Mutli Colour

\*(4)---Display mode

- T – TN  
V – TN (Negative)  
S – STN Yellow green  
G – STN Grey  
B – STN Blue (Negative)  
F – FSTN  
N – FSTN (Negative)

\*(5)---Rear polarizer type

- R – Reflective  
F – Transflective  
T – Transmissive

\*(6)---Temperature range

- N – Normal  
W– Extended

\*(7)---Viewing direction

- 6 – 6 O'clock  
2 – 12 O'clock  
3 – 3 O'clock  
9 – 9 O'clock

\*(8)---Special code for other requirements  
(Can be omitted if not used)

**GENERAL DESCRIPTION**

Display mode : 128 X 64 dots, Graphic COG LCD module  
 Interface : Parallel/serial  
 Driving method : 1/65 duty, 1/9 bias  
 Controller IC : Ultrachip UC1701X or equivalent  
 For the detailed information, please refer to the IC specifications.

**MECHANICAL DIMENSIONS**

Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension			Dot Pitch	0.27(L)x0.27(W)	mm
No backlight	43.0(L) x29.14 (W) x2.1 (H)(MAX)	mm	Dot Size	0.255(L)x0.255(W)	mm
LED side-lited backlight	44.3(L) x30.14 (W) x 7.9(H)	mm	Viewing Area	37.04(L)x20.24(W)	mm

**CONNECTOR PIN ASSIGNMENT**

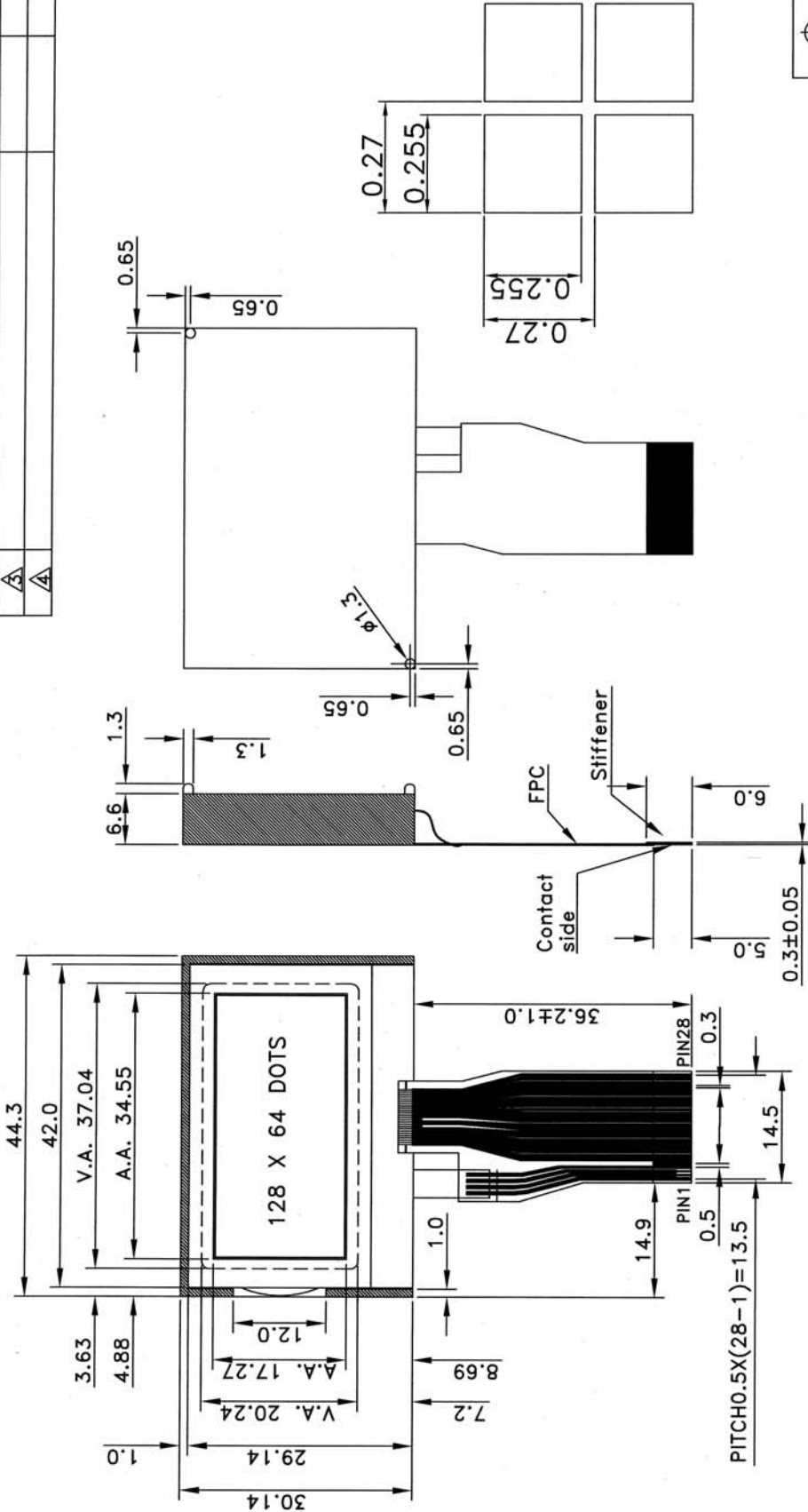
Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	A	Supply voltage for backlight(+VE)	15	VDD	Power supply for logic(VDD)
2	K1	Supply voltage for backlight(-VE)	16	D7(SID)	Data bus(serial data)
3	*K2	For RGB	17	D6(SCK)	Data bus(serial clock)
4	*K3	For RGB	18	D5	Data bus
5	NC	No connection	19	D4	
6	BM1	Bus mode select	20	D3	
7	BM0		21	D2	
8	VLCDOUT	Main LCD power supply	22	D1	
9	VLCDIN		23	D0	
10	VB1+	LCD bias voltage	24	WR1	Read/write operation control
11	VB1-		25	WR0	
12	VB0-		26	CD	Register select
13	VB0+		27	RST	Reset
14	VSS	Power supply (0V)	28	CS0	Chip select

Note (\*): Pin 3, 4 are used for RGB backlight version

COUNTER DRAWING OF MODULE DIMENSION

MARK	REASON	PREPARED	DATE
A	Add no backlight version dimension	Timmy	31 MAY 10
A	Add new color backlight specification	Timmy	14 JUL 11
A			
A			


Side-lite backlight version

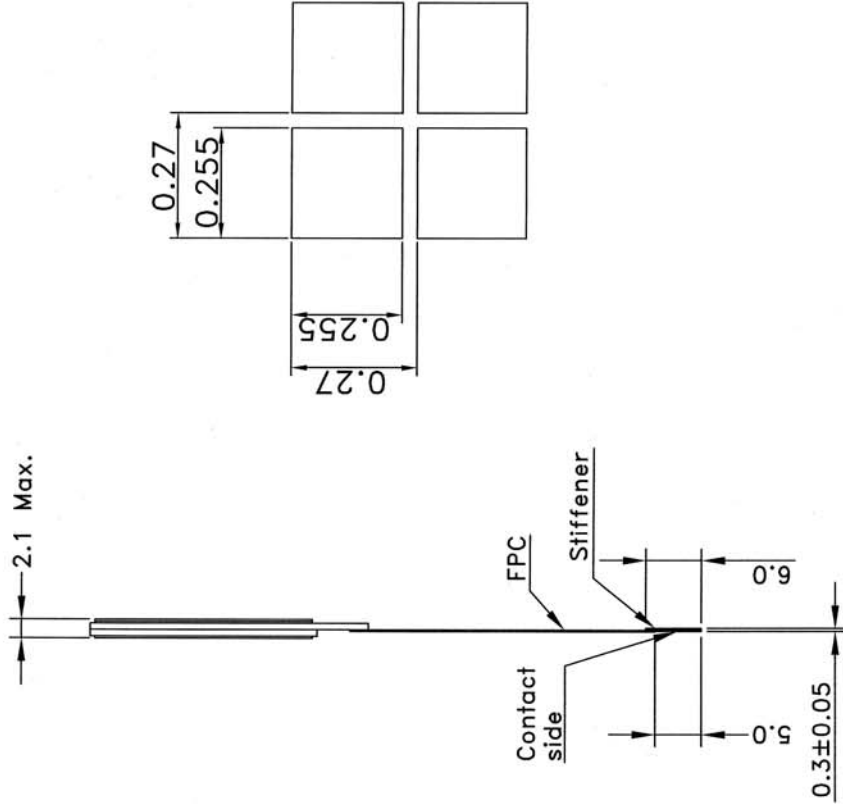
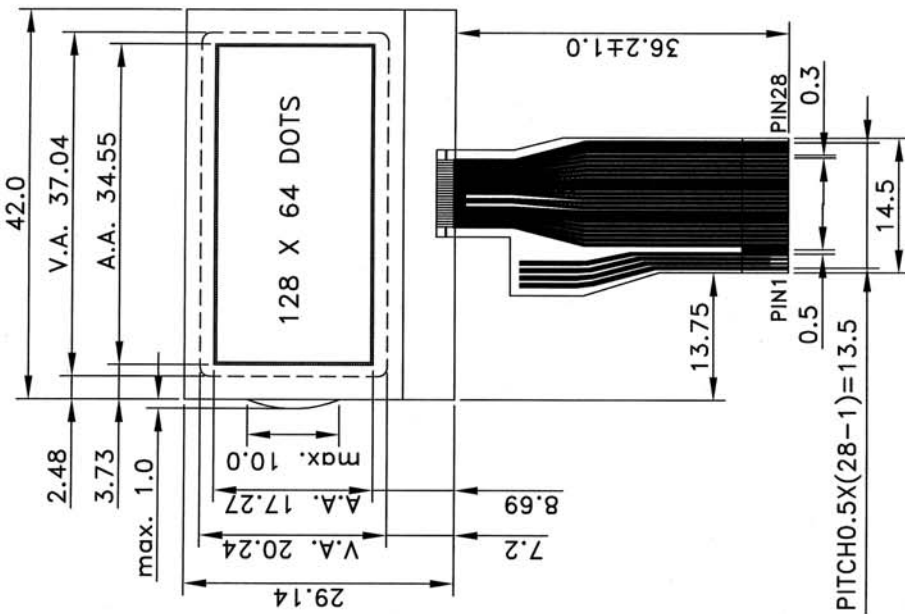


TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 1 OF 4
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO. CG12864A	
00	1st Issue	19 MAY 09	STANDARD		TITLE: MODULE DIMENSION 1	
01	Add no backlight version dimension	31 MAY 10	AGENT		DRAWN BY: FAN	DATE: 14 JUL 11
02	Add new color backlight specification	14 JUL 11			CHECKED BY:	DATE: 14 JUL 11
			CUSTOMER REF.	OUR REF. X9040	APPROVED BY:	DATE: 14 JUL 11



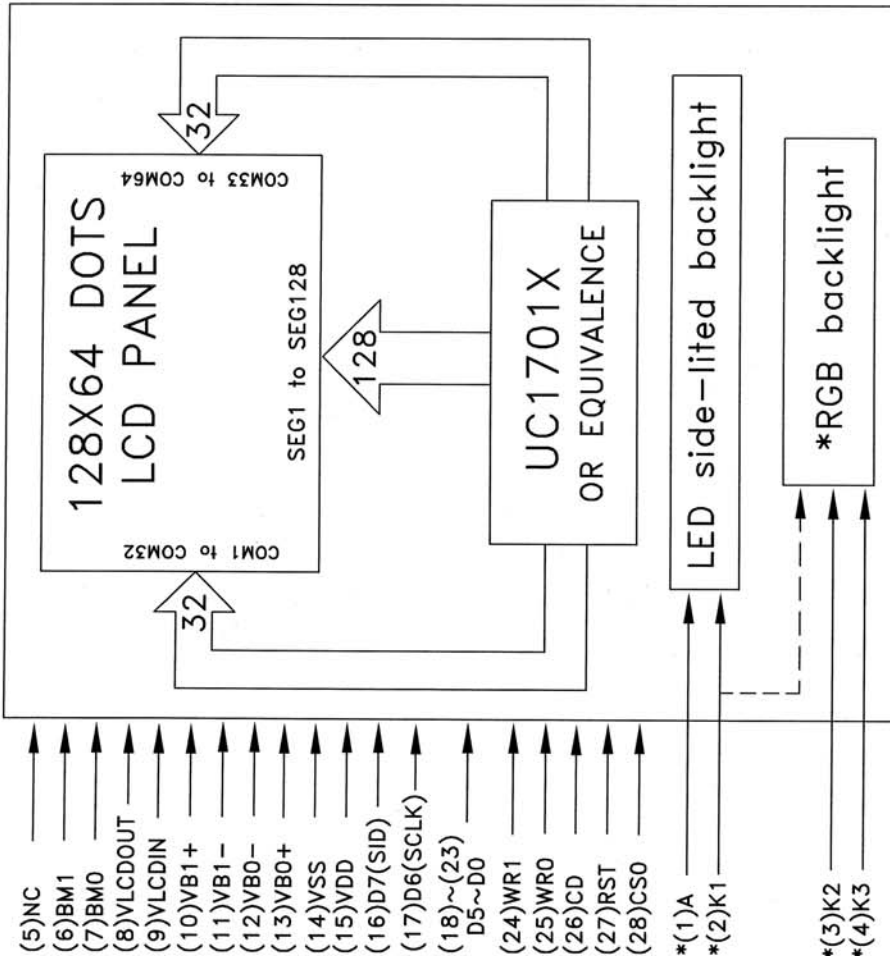
COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM

No backlight version 



TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 2 OF 4
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO. CG12864A	
00	1st Issue	19 MAY 09	STANDARD	APPROVED	TITLE: MODULE DIMENSION 2	
01	Add no backlight version dimension	31 MAY 10		APPROVED	DRAWN BY: FAN	DATE: 14 JUL 11
02	Add new color backlight specification	14 JUL 11		AGENT	CHECKED BY: <i>[Signature]</i>	DATE: 16 Jul 11
			CUSTOMER REF.	OUR REF. X9040	APPROVED BY: <i>[Signature]</i>	DATE: 14 Jul 11

COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



PIN NO.	SYMBOL	FUNCTION
*1	A	Supply voltage for backlight (+VE)
*2	K1	Supply voltage for backlight (-VE)
**3	K2	For RGB
**4	K3	For RGB
5	NC	No connection
6	BM1	Bus mode select
7	BMO	Bus mode select
8	VLCDOUT	Main LCD power supply
9	VLCDIN	Main LCD power supply
10	VB1+	LCD bias voltage
11	VB1-	LCD bias voltage
12	VB0-	LCD bias voltage
13	VB0+	LCD bias voltage
14	VSS	Power supply (0V)
15	VDD	Power supply for logic(VDD)
16	D7(SID)	Data bus (Serial data)
17	D6(SCLK)	Data bus (Serial clock)
18	D5	Data bus
19	D4	Data bus
20	D3	Data bus
21	D2	Data bus
22	D1	Data bus
23	D0	Data bus
24	WR1	Read/write operation control
25	WRO	Read/write operation control
26	CD	Register select
27	RST	Reset
28	CSO	Chip select

NOTE: \* for side-lite backlight version only  
 \*\* for RGB side-lite backlight version only

TOLERANCE IF NOT SPECIFY ±0.5mm		SCALE N.T.S.	UNIT IN mm	CLOVER DISPLAY LTD. (HK)		SHEET 3 OF 4
REV.	REVISION RECORD	DATE	CUSTOMER	APPROVED	MODEL NO. CG12864A	
00	1st Issue	19 MAY 09	STANDARD		TITLE: PIN OUT & BLOCK DIAGRAM	
01	Add no backlight version dimension	31 MAY 10	AGENT	APPROVED	DRAWN BY: FAN	DATE: 14 JUL 11
02	Add new color backlight specification	14 JUL 11			CHECKED BY: <i>[Signature]</i>	DATE: 16 Jul 11
			CUSTOMER REF.	OUR REF. X9040	APPROVED BY: <i>[Signature]</i>	DATE: 14 Jul 11

**ELECTRICAL CHARACTERISTICS**

Conditions: VSS=0V, Ta=25°C

Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	3.05	3.3	3.55	V
Supply Current for Logic	IDD	—	0.29	0.43	mA
Operating Voltage for LCD (*)	VLCD	8.55	9.0	9.45	V
'High' Level Input Voltage	VIH	0.8VDD	—	—	V
'Low' Level Input Voltage	VIL	—	—	0.2VDD	V

Note (\*): There is tolerance in optimum LCD driving voltage during production and it will be within the specified range.

**Side-lited LED BL:**

Constant voltage driving:

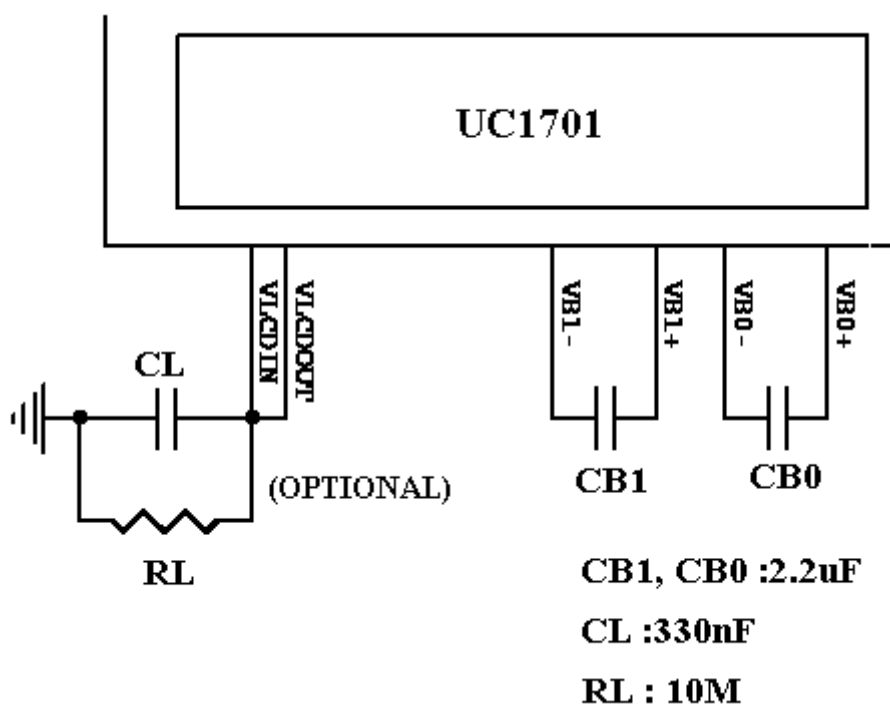
Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Backlight current (White)	I <sub>BL</sub>	—	15	20	mA	V <sub>BL</sub> = 3.3V
Backlight current (Blue)	I <sub>BL</sub>	—	15	20	mA	V <sub>BL</sub> = 3.3V
Backlight current (Yellow Green)	I <sub>BL</sub>	—	24	30	mA	V <sub>BL</sub> = 3.3V
Backlight current (Red)	I <sub>BL</sub>	—	24	30	mA	V <sub>BL</sub> = 3.3V
Backlight current (Amber)	I <sub>BL</sub>	—	24	30	mA	V <sub>BL</sub> = 3.3V
Backlight current (Orange)	I <sub>BL</sub>	—	24	30	mA	V <sub>BL</sub> = 3.3V

**RGB BL:**

Constant voltage driving:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Backlight current (Red)	I <sub>BL</sub>	—	10	15	mA	V <sub>BL</sub> = 4.0V
Backlight current (Green)	I <sub>BL</sub>	—	15	20	mA	V <sub>BL</sub> = 4.0V
Backlight current (Blue)	I <sub>BL</sub>	—	15	20	mA	V <sub>BL</sub> = 4.0V

**REFERENCE CIRCUIT EXAMPLE**





**ABSOLUTE MAXIMUM RATINGS**

Please make sure not to exceed the following maximum rating values under the worst application conditions

Item	Symbol	Rating (for normal temperature)	Rating (for wide temperature)	Unit
Supply Voltage	VDD	-0.3 to +4.0	-0.3 to +4.0	V
Input Voltage	VT	-0.4 to VDD +0.3	-0.4 to VDD +0.3	V
Operating Temperature	Topr	0 to 50	-20 to 70	°C
Storage Temperature	Tstg	-10 to 60	-30 to 80	°C

**INSTRUCTIONS TABLE**

The following is a list of host commands supported by UC1701x

C/D: 0: Control, 1: Data  
W/R: 0: Write Cycle, 1: Read Cycle  
# Useful Data bits – Don't Care

	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Default
1.	Write Data Byte	1	0	#	#	#	#	#	#	#	#	Write 1 byte	N/A
2.	Read Data Byte	1	1	#	#	#	#	#	#	#	#	Read 1 byte	N/A
3.	Get Status	0	1	BZ	MX	DE	RST	0	0	0	0	Get Status	--
4.	Set Column Address LSB	0	0	0	0	0	0	#	#	#	#	Set CA [3:0]	0
	Set Column Address MSB			0	0	0	1	#	#	#	#	Set CA [7:4]	0
5.	Set Power Control	0	0	0	0	1	0	1	#	#	#	Set PC[2:0]	000b
6.	Set Scroll Line	0	0	0	1	#	#	#	#	#	#	Set SL[5:0]	0
7.	Set Page Address	0	0	1	0	1	1	#	#	#	#	Set PA[3:0]	0
8.	Set V <sub>LCD</sub> Resistor Ratio	0	0	0	0	1	0	0	#	#	#	Set PC[5:3]	100b
9.	Set Electronic Volume (double-byte command)	0	0	1	0	0	0	0	0	0	1	Set PM[5:0]	20H
				0	0	#	#	#	#	#	#		
10.	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]	0b
11.	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]	0b
12.	Set Display Enable	0	0	1	0	1	0	1	1	1	#	Set DC[2]	0b
13.	Set SEG Direction	0	0	1	0	1	0	0	0	0	#	Set LC[0]	0b
14.	Set COM Direction	0	0	1	1	0	0	#	-	-	-	Set LC[1]	0b
15.	System Reset	0	0	1	1	1	0	0	0	1	0	System Reset	N/A
16.	NOP	0	0	1	1	1	0	0	0	1	1	No operation	N/A
17.	Set LCD Bias Ratio	0	0	1	0	1	0	0	0	1	#	Set BR	0b
18.	Set Cursor Update Mode	0	0	1	1	1	0	0	0	0	0	AC3=1, CR=CA	N/A
19.	Reset Cursor Update Mode	0	0	1	1	1	0	1	1	1	0	AC3=0, CA=CR.	N/A
20.	Set Static Indicator OFF	0	0	1	0	1	0	1	1	0	0	NOP	N/A
21.	Set Static Indicator ON	0	0	1	0	1	0	1	1	0	1	NOP	N/A
	Set Static Indicator			-	-	-	-	-	-	-			
22.	Set Booster Ratio (double-byte command)	0	0	1	1	1	1	1	0	0	0	NOP	00b
				0	0	0	0	0	0	#	#		
23.	Set Power Save (compound command)	0	0	#	#	#	#	#	#	#	#	Display OFF & All Pixel ON	N/A
24.	Set Test Control (double-byte command)	0	0	1	1	1	1	1	1	TT		For UCI only Do NOT use	N/A
				-	#	#	#	#	#	#	#		
25.	Set Adv. Program Control 0 (double-byte command)	0	0	1	1	1	1	1	0	1	0	Set TC, WA[1:0]	90H
				#	0	0	1	0	0	#	#		
26.	Set Adv. Program Control 1 (double-byte command)	0	0	1	1	1	1	1	0	1	1	For UCI only Set APC1	N/A
				#	#	#	#	#	#	#	#		

\* Other than commands listed above, all other bit patterns result in NOP (No Operation).

**RECOMMENDED INITIAL SETTINGS**

Set ADV. Program Control (double-byte command) : FAH, 90H  
Set SEG Direction : A0H  
Set COM Direction : C8H  
Set LCD Bias Ratio : A2H  
Set VLCD Resistor Ratio : 25H  
Set Power Control : 2FH  
Set Electronic Volume(double-byte command) : 81H , 19H  
Set Cursor Update Mode: E0H  
Set Page Address (page=0): B0H  
Set Scroll Line (row=0): 40H  
Set Column Address (column=0) (double-byte command) : 00H(LSB), 10H(MSB)  
Set Display Enable: AFH

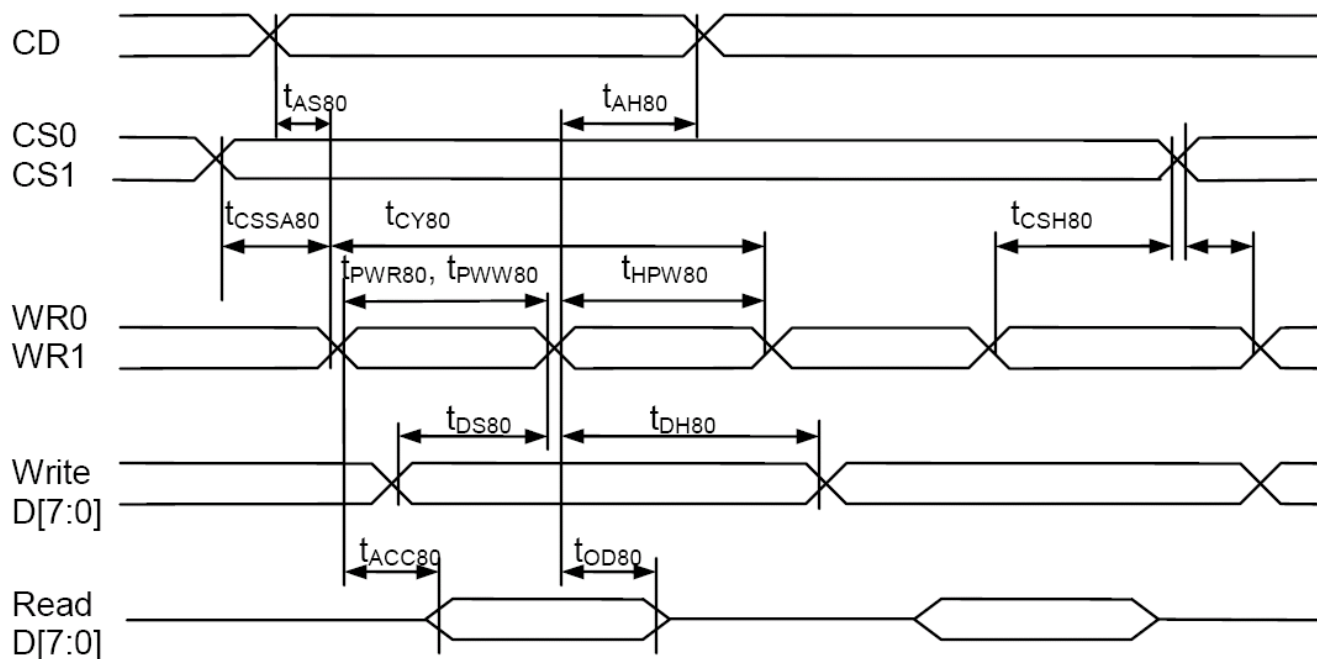
DISPLAY DATA RAM

PA[3:0]	0	Line AddrCcss									MY=0		MY=1								
											SL=0	SL=16	SL=0	SL=0	SL=25	SL=25					
0000	D0	00H	<div style="display: flex; justify-content: space-between;"> <span>1</span> <span>0</span> </div>								C1	C49	C64	C48	C25	C9					
	D1	01H									C2	C50	C63	C47	C24	C8					
	D2	02H									C3	C51	C62	C46	C23	C7					
	D3	03H									C4	C52	C61	C45	C22	C6					
	D4	04H									C5	C53	C60	C44	C21	C5					
	D5	05H									C6	C54	C59	C43	C20	C4					
	D6	06H									C7	C55	C58	C42	C19	C3					
	D7	07H									C8	C56	C57	C41	C18	C2					
0001	D0	08H	<div style="display: flex; justify-content: space-between;"> <span>1</span> <span>0</span> </div>								C9	C57	C56	C40	C17	C1					
	D1	09H									C10	C58	C55	C39	C16	---					
	D2	0AH									C11	C59	C54	C38	C15	---					
	D3	0BH									C12	C60	C53	C37	C14	---					
	D4	0CH									C13	C61	C52	C36	C13	---					
	D5	0DH									C14	C62	C51	C35	C12	---					
	D6	0EH									C15	C63	C50	C34	C11	---					
	D7	0FH									C16	C64	C49	C33	C10	---					
0010	D0	10H	<div style="display: flex; justify-content: space-between;"> <span>1</span> <span>0</span> </div>								C17	C1	C48	C32	C9	---					
	D1	11H									C18	C2	C47	C31	C8	---					
	D2	12H									C19	C3	C46	C30	C7	---					
	D3	13H									C20	C4	C45	C29	C6	---					
	D4	14H									C21	C5	C44	C28	C5	---					
	D5	15H									C22	C6	C43	C27	C4	---					
	D6	16H									C23	C7	C42	C26	C3	---					
	D7	17H									C24	C8	C41	C25	C2	---					
0011	D0	18H	<div style="display: flex; justify-content: space-between;"> <span>1</span> <span>0</span> </div>								C25	C9	C40	C24	C1	---					
	D1	19H									C26	C10	C39	C23	C64	C48*					
	D2	1AH									C27	C11	C38	C22	C63	C47					
	D3	1BH									C28	C12	C37	C21	C62	C46					
	D4	1CH									C29	C13	C36	C20	C61	C45					
	D5	1DH									C30	C14	C35	C19	C60	C44					
	D6	1EH									C31	C15	C34	C18	C59	C43					
	D7	1FH									C32	C16	C33	C17	C58	C42					
0100	D0	20H	<div style="display: flex; justify-content: space-between;"> <span>1</span> <span>0</span> </div>								C33	C17	C32	C16	C57	C41					
	D1	21H									C34	C18	C31	C15	C56	C40					
	D2	22H									C35	C19	C30	C14	C55	C39					
	D3	23H									C36	C20	C29	C13	C54	C38					
	D4	24H									C37	C21	C28	C12	C53	C37					
	D5	25H									C38	C22	C27	C11	C52	C36					
	D6	26H									C39	C23	C26	C10	C51	C35					
	D7	27H									C40	C24	C25	C9	C50	C34					
0101	D0	28H	<div style="display: flex; justify-content: space-between;"> <span>1</span> <span>0</span> </div>								C41	C25	C24	C8	C49	C33					
	D1	29H									C42	C26	C23	C7	C48	C32					
	D2	2AH									C43	C27	C22	C6	C47	C31					
	D3	2BH									C44	C28	C21	C5	C46	C30					
	D4	2CH									C45	C29	C20	C4	C45	C29					
	D5	2DH									C46	C30	C19	C3	C44	C28					
	D6	2EH									C47	C31	C18	C2	C43	C27					
	D7	2FH									C48	C32	C17	C1	C42	C26					
0110	D0	30H	<div style="display: flex; justify-content: space-between;"> <span>1</span> <span>0</span> </div>								C49	C33	C16	---	C41	C25					
	D1	31H									C50	C34	C15	---	C40	C24					
	D2	32H									C51	C35	C14	---	C39	C23					
	D3	33H									C52	C36	C13	---	C38	C22					
	D4	34H									C53	C37	C12	---	C37	C21					
	D5	35H									C54	C38	C11	---	C36	C20					
	D6	36H									C55	C39	C10	---	C35	C19					
	D7	37H									C56	C40	C9	---	C34	C18					
0111	D0	38H	<div style="display: flex; justify-content: space-between;"> <span>1</span> <span>0</span> </div>								C57	C41	C8	---	C33	C17					
	D1	39H									C58	C42	C7	---	C32	C16					
	D2	3AH									C59	C43	C6	---	C31	C15					
	D3	3BH									C60	C44	C5	---	C30	C14					
	D4	3CH									C61	C45	C4	---	C29	C13					
	D5	3DH									C62	C46	C3	---	C28	C12					
	D6	3EH									C63	C47	C2	---	C27	C11					
	D7	3FH									C64	C48	C1	---	C26	C10					
1000	D0	40H	<div style="display: flex; justify-content: space-between;"> <span>1</span> <span>0</span> </div>								CIC	CIC	CIC	CIC	CIC	CIC					
											65      49      65      49 MUX										
											SEG132	SEG1	SEG132	SEG1							
											SEG131	SEG2	SEG131	SEG2							
											SEG130	SEG3	SEG130	SEG3							
											SEG129	SEG4	SEG129	SEG4							
											SEG128	SEG5	SEG128	SEG5							
											SEG127	SEG6	SEG127	SEG6							
								SEG126	SEG7	SEG126	SEG7										
								SEG125	SEG8	SEG125	SEG8										
								SEG128	SEG128	SEG128	SEG128										
								SEG129	SEG129	SEG129	SEG129										
								SEG130	SEG130	SEG130	SEG130										
								SEG131	SEG131	SEG131	SEG131										
								SEG132	SEG132	SEG132	SEG132										

Example for memory mapping: let MX = 0, MY = 0, SL = 0, according to the data shown in the above table:

- ⇒ Page 0 SEG 1 (D7-D0) : 11100000b
- ⇒ Page 0 SEG 2 (D7-D0) : 00110011b

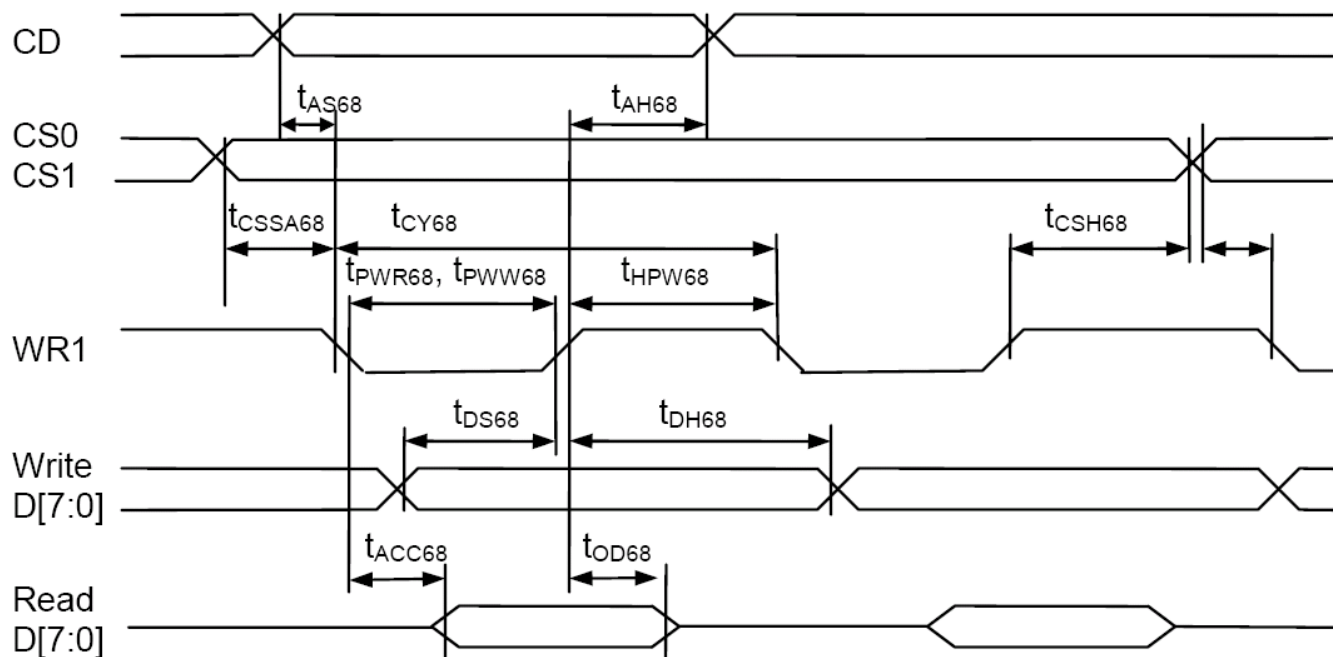
**PARALLEL INTERFACE TIMING DIAGRAM(8080 MODE)**



**PARALLEL INTERFACE TIMING CHARACTERISTICS (8080 MODE)**

Symbol	Signal	Description	Condition	Min.	Max.	Units
$t_{AS80}$ $t_{AH80}$	CD	Address	setup time hold time	0 5	-	nS
$t_{CSSA80}$ $t_{CSH80}$	CS1/CS0	Chip select	setup time hold time	5 5	-	nS
$t_{CY80}$		Cycle time	read write	120 80	-	nS
$t_{PWR80}$ $t_{PWW80}$	WR1 WR0	Pulse width	read write	60 40	-	nS
$t_{HPW80}$	WR0, WR1	High pulse width	read write	60 40	-	nS
$t_{DS80}$ $t_{DH80}$	D7~D0	Data	setup time hold time	30 0	-	nS
$t_{ACC80}$ $t_{OD80}$		Read access time Output disable time	$C_L = 100pF$	- 20	60 -	nS

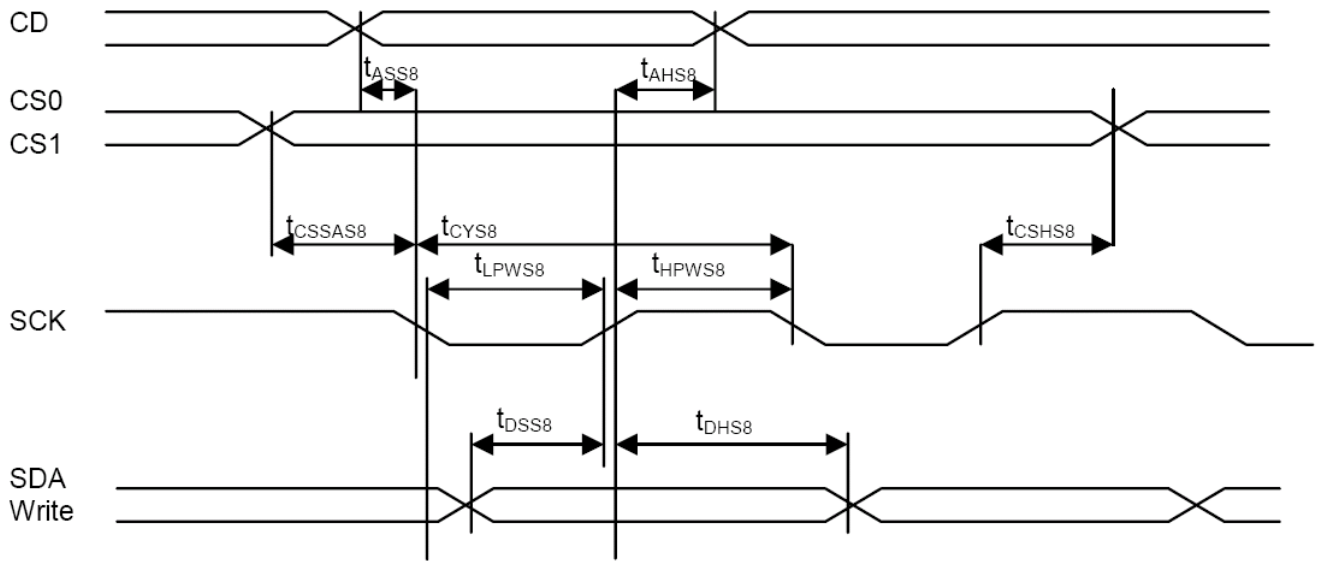
**PARALLEL INTERFACE TIMING DIAGRAM(6800 MODE)**



**PARALLEL INTERFACE TIMING CHARACTERISTICS (6800 MODE)**

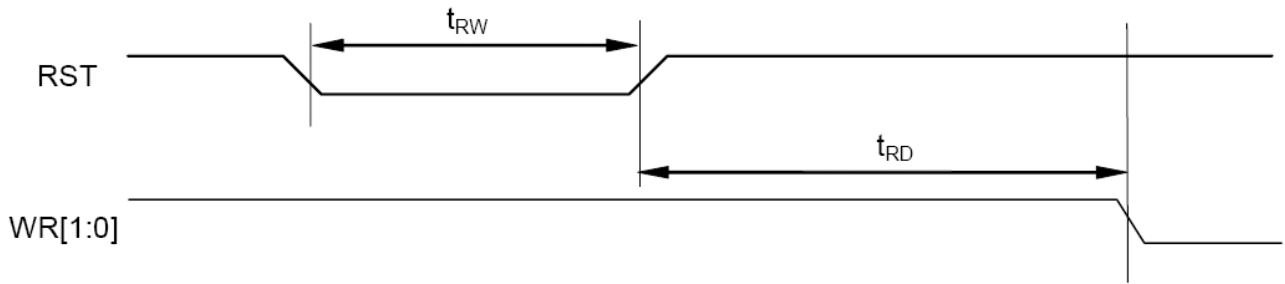
Symbol	Signal	Description	Condition	Min.	Max.	Units
$t_{AS68}$	CD	Address	setup time	0	-	nS
$t_{AH68}$			hold time	0	-	
$t_{CSSA68}$	CS1/CS0	Chip select	setup time	5	-	nS
$t_{CSH68}$			hold time	5	-	
$t_{CY68}$		System cycle time	read	120	-	nS
			write	80	-	
$t_{PWR68}$	WR1	Pulse width	read	60	-	nS
$t_{PWW68}$			write	40	-	
$t_{HPW68}$		High pulse width	read	60	-	nS
			write	40	-	
$t_{DS68}$	D7~D0	Data	setup time	30	-	nS
$t_{DH68}$			hold time	0	-	
$t_{ACC68}$		Read access time	$C_L = 100pF$	-	60	nS
$t_{OD68}$		Output disable time		50	-	

**SERIAL INTERFACE TIMING DIAGRAM (FOR S8)**



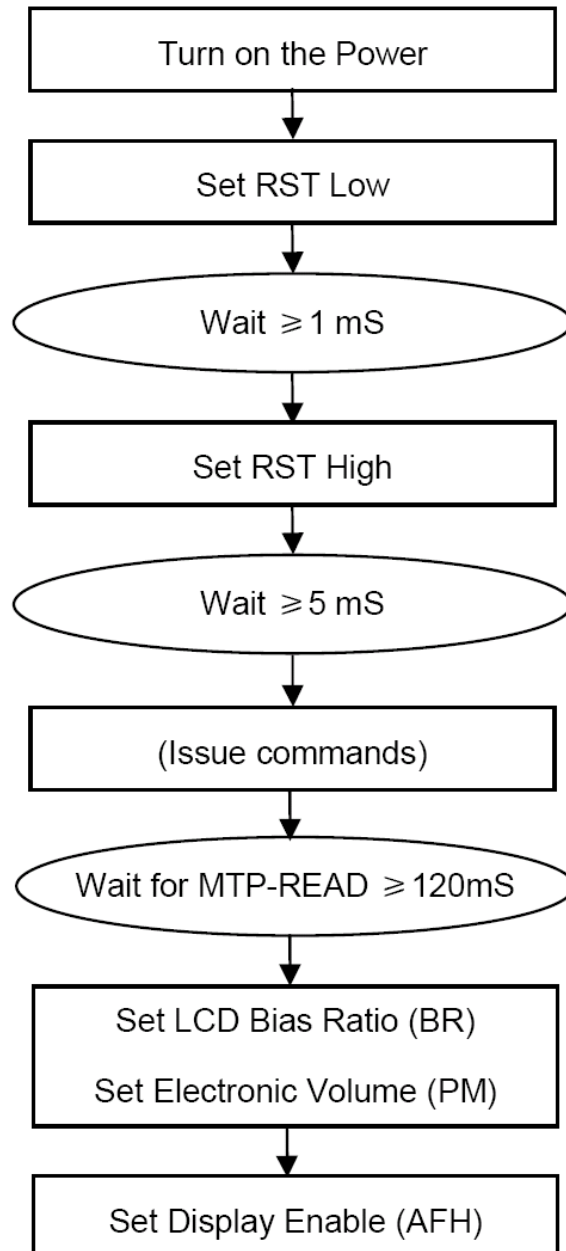
**SERIAL INTERFACE TIMING CHARACTERISTICS (FOR S8)**

Symbol	Signal	Description	Condition	Min.	Max.	Units
$t_{ASS8}$	CD	Address	setup time	0	-	nS
$t_{AHS8}$			hold time	0	-	
$t_{CSSAS8}$	CS1/CS0	Chip select	setup time	5	-	nS
$t_{CSHS8}$			hold time	5	-	
$t_{CYS8}$	SCK	Cycle time	read	100	-	nS
			write	30	-	
$t_{LPWS8}$		Low pulse width	read	50	-	nS
			write	15	-	
$t_{HPWS8}$	High pulse width	read	50	-	nS	
		write	15	-		
$t_{DSS8}$	SDA	Data	setup time	12	-	nS
$t_{DHS8}$			hold time	0	-	

**RESET TIMING DIAGRAM****RESET TIMING**

Symbol	Signal	Description	Condition	Min.	Max.	Units
$t_{RW}$	RST	Reset low pulse width		3	–	$\mu$ S
$t_{RD}$	RST, WR	Reset to WR pulse delay		6	–	mS

## INITIALIZING WITHOUT THE BUILT-IN POWER SUPPLY CIRCUITS





**ELECTRO-OPTICAL CHARACTERISTICS**

MEASURING CONDITION: POWER SUPPLY =  $V_{OP} / 64 \text{ Hz}$   
 TEMPERATURE =  $23 \pm 5 \text{ }^\circ\text{C}$   
 RELATIVE HUMIDITY =  $60 \pm 20 \%$

ITEM	SYMBOL	UNIT	TYP. STN
RESPONSE TIME	$T_{on}$	ms	220
	$T_{off}$	ms	280
CONTRAST RATIO	$Cr$	-	12
VIEWING ANGLE ( $Cr \geq 2$ )	$V_{3:00}$	$^\circ$	40
	$V_{6:00}$	$^\circ$	70
	$V_{9:00}$	$^\circ$	40
	$V_{12:00}$	$^\circ$	50

THE ELECTRO-OPTICAL CHARACTERISTICS ARE MEASURED VALUE BUT NOT GUARANTEED ONES.

**RELIABILITY OF LCD MODULE**

ITEM	TEST CONDITION FOR NORMAL TEMPERATURE	TEST CONDITION FOR WIDE TEMPERATURE	TIME
High temperature operating	50°C	70°C	240 hours
Low temperature operating	0°C	-20°C	240 hours
High temperature storage	60°C	80°C	240 hours
Low temperature storage	-10°C	-30°C	240 hours
Temperature-humidity storage	40°C 90% R.H.	60°C 90% R.H.	96 hours
Temperature cycling	-10°C to 60°C 30 Min Dwell	-30°C to 80°C 30 Min Dwell	5 cycle
Vibration Test at LCM Level	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	—

**QUALITY STANDARD OF LCD MODULE**

<b>1.0</b>	<b>Sampling Method</b>		
	Sampling Plan : MIL STD 105 E Class of AQL : Level II/Single Sampling Critical : 0.25% Major 0.65% Minor 1.5%		
<b>2.0</b>	<b>Defect Group</b>	<b>Failure Category</b>	<b>Failure Reasons</b>
	Critical Defect 0.25%(AQL)	Malfunction	Open Short Burnt or dead component Missing part/improper part P.C.B. Broken
	Major Defect 0.65%(AQL)	Poor Insulation	Potential short High current Component damage or scratched or Lying too close improper coating
		Poor Conduction	Damage joint Wrong polarity Wrong spec. part Uneven/intermittent contact Loose part Copper peeling Rust or corrosion or dirt's
	Minor Defect 1.5%(AQL)	Cosmetic Defect	Minor scratch Flux residue Thin solder Poor plating Poor marking Crack solder Poor bending Poor packing Wrong size

**SAMPLING METHOD**

SAMPLING PLAN: MIL-STD 105E

CLASS OF AQL: LEVEL II/ SINGLE SAMPLING  
 MAJOR-0.65% MINOR – 1.5%

**QUALITY STANDARD**

DEFECT	CRITERIA	TYPE	FIGURE
SHORT CIRCUIT	-	MAJOR	-
MISSING SEGMENT	-	MAJOR	-
UNEVEN / POOR CONTRAST	-	MAJOR	-
CROSS TALK	-	MAJOR	-
PIN HOLE	$MAX(a,b) \leq 1/4 W$	MINOR	1
EXCESS SEGMENT	$MAX(c,d) \leq 1/4 T$	MINOR	1
BUBBLES	$d^* \geq 0.2$ QTY=0	MINOR	2
BLACKS SPOTS	$d \leq 0.3$ N.A.** $0.3 < d \leq 0.4$ QTY $\leq$ 1 $0.4 < d$ QTY=0	MINOR	2
LINE SCRATCHES	$x \geq 0.7$ $y \geq 0.05$ QTY=0	MINOR	3
BLACK LINE	$x \geq 0.7$ $y \geq 0.05$ QTY=0	MINOR	3

\*d = MAX (d<sub>1</sub>,d<sub>2</sub>)

\*\* N. A . = NOT APPLICABLE

DEFECT TABLE : B

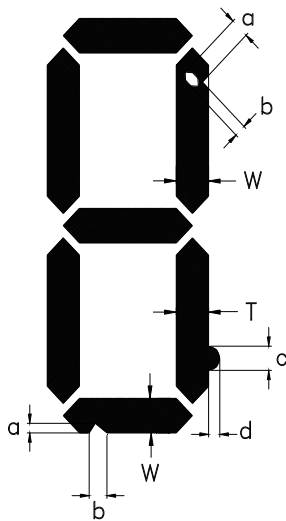
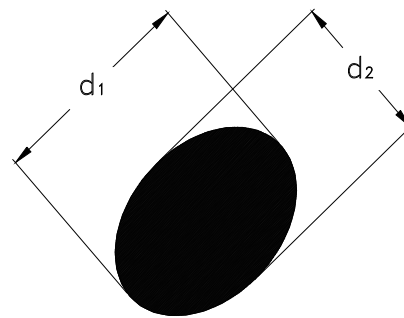
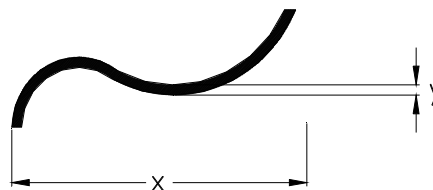


fig . 1



POLARIZER BUBBLES / SPOTS

fig . 2



LINE SCRATCHES / BLACK LINE

fig . 3

QUALITY STANDARD ( CONT . )

DEFECT		CRITERIA	TYPE	FIGURE
CHIPS	CONTACT EDGE	$e \leq 1/2T$ $f \leq 1/3W$ $g \leq 3.5$	MINOR	4
	BOTTOM GLASS	$p \leq 1.0$ $q \leq 3.5$ $r \leq 1/2T$		4
	CORNER	$a \leq 1.5$ $b \leq W$		4
	TOP GLASS	$a \leq 3.0$ $b \leq 1/3T$ $c \leq 1/2W$		5
GLASS PROTRUSION		$a \leq 1/4 W$	MINOR	6
RAINBOW		-	MINOR	-

UNLESS STATE OTHERWISE , ALL UNIT ARE IN MILLIMETER .

DEFECT TABLE : B

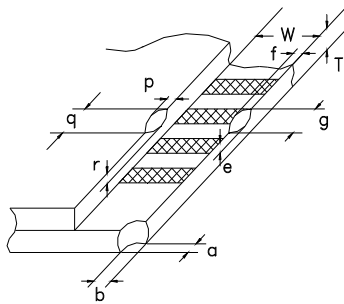


fig . 4

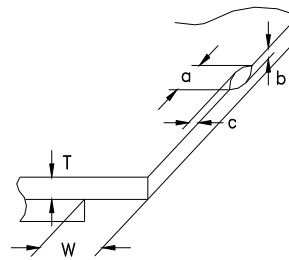


fig . 5

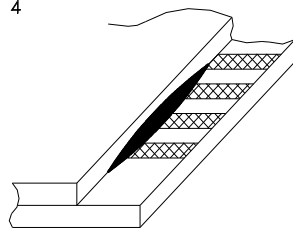
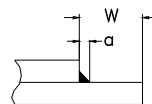


fig . 6



## HANDLING PRECAUTIONS

### (1) CAUTION OF LCD HANDLING & CLEANING

The polarizing plate on the surface of the panel is made from organic substances. Be very careful for chemicals not to touch the plate or it leads the polarizing plate to deteriorate.

If the use of a chemical is unavoidable, wipe the panel lightly with soft materials, such as gauze and absorbent cotton, soaked in a solvent.

\*Usable solvent: Alcohol (ethanol, IPA and the like)

\*Appropriate solvent: Ketones, ethyl alcohol

Avoid wiping with a dry cloth, since it could damage the surface of the polarizing plate and others.

### (2) CAUTION AGAINST STATIC CHARGE

The LCD modules use CMOS LSI drivers, so customers are recommended that any unused input terminal would be connected to  $V_{DD}$  or  $V_{SS}$ , do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

### (3) ESD PRECAUTION

Inputs and outputs are protected against electrostatic discharge in normal handling. However, to be totally safe, it is recommended to take normal precautions appropriate to handling LCM module. For example: product surface grounding. Always take ESD precaution when handling the *LCD Module*. Components are exposed for direct finger touches and can be damaged unless ESD precaution is taken.

### (4) PACKAGING

Avoid intense shock and falls from a height and do not operate or store them exposed to direct sunshine or high temperature/humidity for long periods.

### (5) CAUTION FOR OPERATION

The viewing angle can be adjusted by varying the LCD driving voltage  $V_O$ .

Driving voltage should be kept within specified range, excess voltage shortens display life.

Response time increases with decrease in temperature.

Display may turn black or dark Blue at temperature above its operational range; this is however not destructive and the display will return to normal once the temperature falls back to range.

Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured". They will recover once the display is turned off.

Condensation at terminals will cause malfunction and possible electrochemical reaction. Relative humidity of the environment should therefore be kept below 60%.

### (6) SAFETY

Liquid crystal may leak out of a damaged LCD, it is recommended to wash off the liquid crystal by using solvents such as acetone or ethanol and should be burned up later.

If any liquid leak out of a damaged glass cell comes in contact with your hands, wash it off with soap and water immediately.

## WARRANTY

CLOVER will replace or repair any of her LCD module in accordance with her LCD specification for a period of one year from date of shipment. The warranty liability of Clover is limited to repair and/or replacement. Clover will not be responsible for any subsequent or consequential event.