CLOVER DISPLAY LTD.

LCD MODULE SPECIFICATION

Model: CG240160B - _ _ - _ _ - _ _ - _

Revision	01
Engineering	Longson Yeung
Date	21 February 2012
Our Reference	X9047

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MODE OF DISPLAY

Display mode	**Display condition**	**Viewing direction**
STN : ☐ Yellow green	☐ Reflective type	☐ 6 O' clock
☐ Grey	☐ Transflective type	☐ 12 O' clock
☐ Blue (negative)	☐ Transmissive type	☐ 3 O' clock
☐ FSTN positive	☐ Others	☐ 9 O' clock
☐ FSTN negative		

LCD MODULE NUMBER NOTATION:

CG240160B- 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
*(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 : 240 X 160 dots, graphic COG LCD module

Interface : 4-bit or 8-bit parallel/serial/I²C

Driving method : 1/160 duty, 1/12 bias

Controller IC : Ultrachip UC1611S or equivalent
For the detailed information, please refer to the IC specifications.

MECHANICAL DIMENSIONS

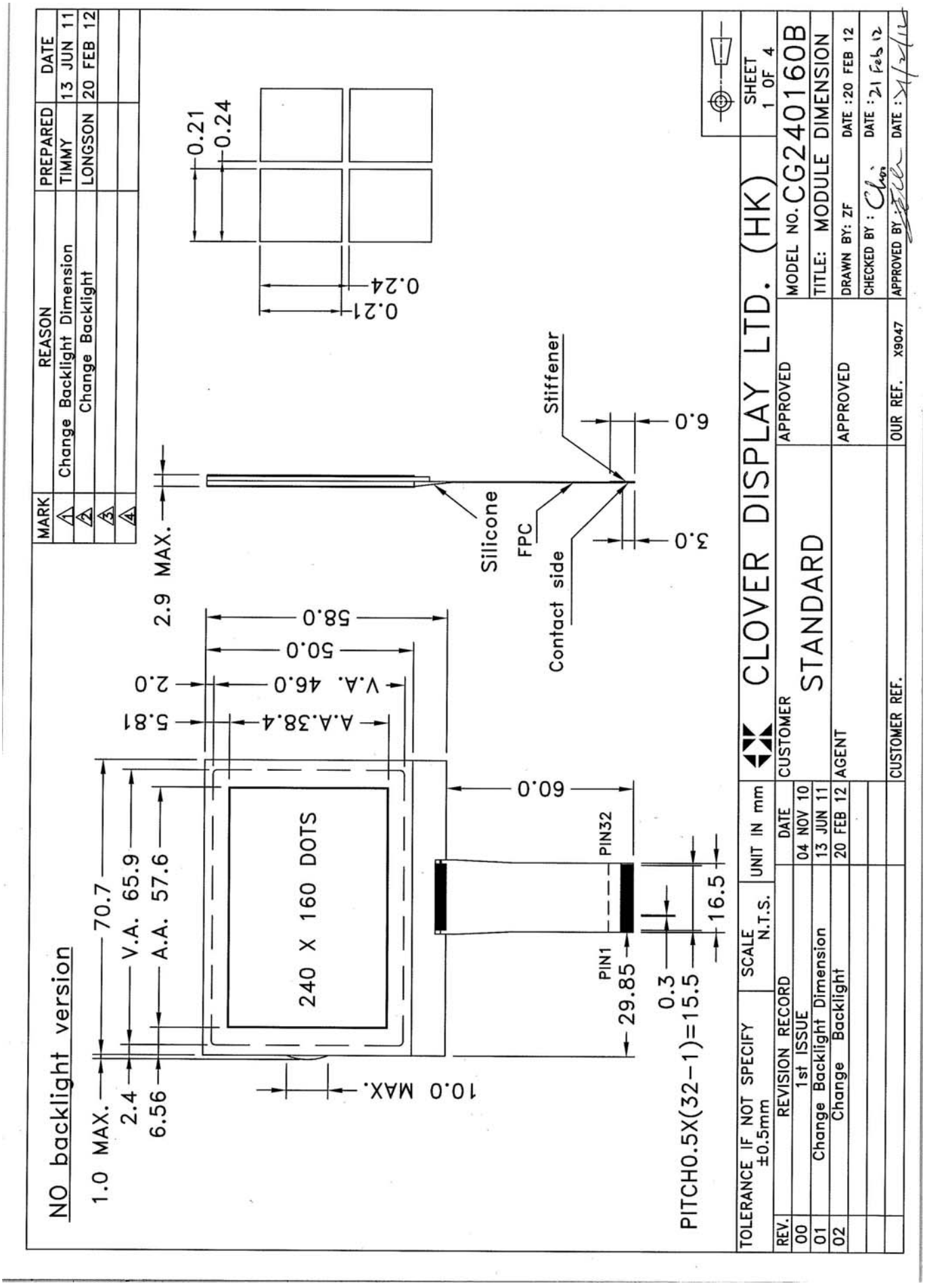
Item	Dimension	Unit	Item	Dimension	Unit
Outline Dimension					
No backlight (N)	70.7(L) x 58.0(W) x 2.9(H)	mm	Dot Size	0.21(L) x 0.21(W)	mm
LED side-lited backlight (L)	70.7(L) x 60.3(W) x 7.0(H)	mm	Dot Pitch	0.24(L) x 0.24(W)	mm
Viewing Area	65.9(L) x 46.0(W)	mm	Active Area	57.6(L) x 38.4(W)	mm

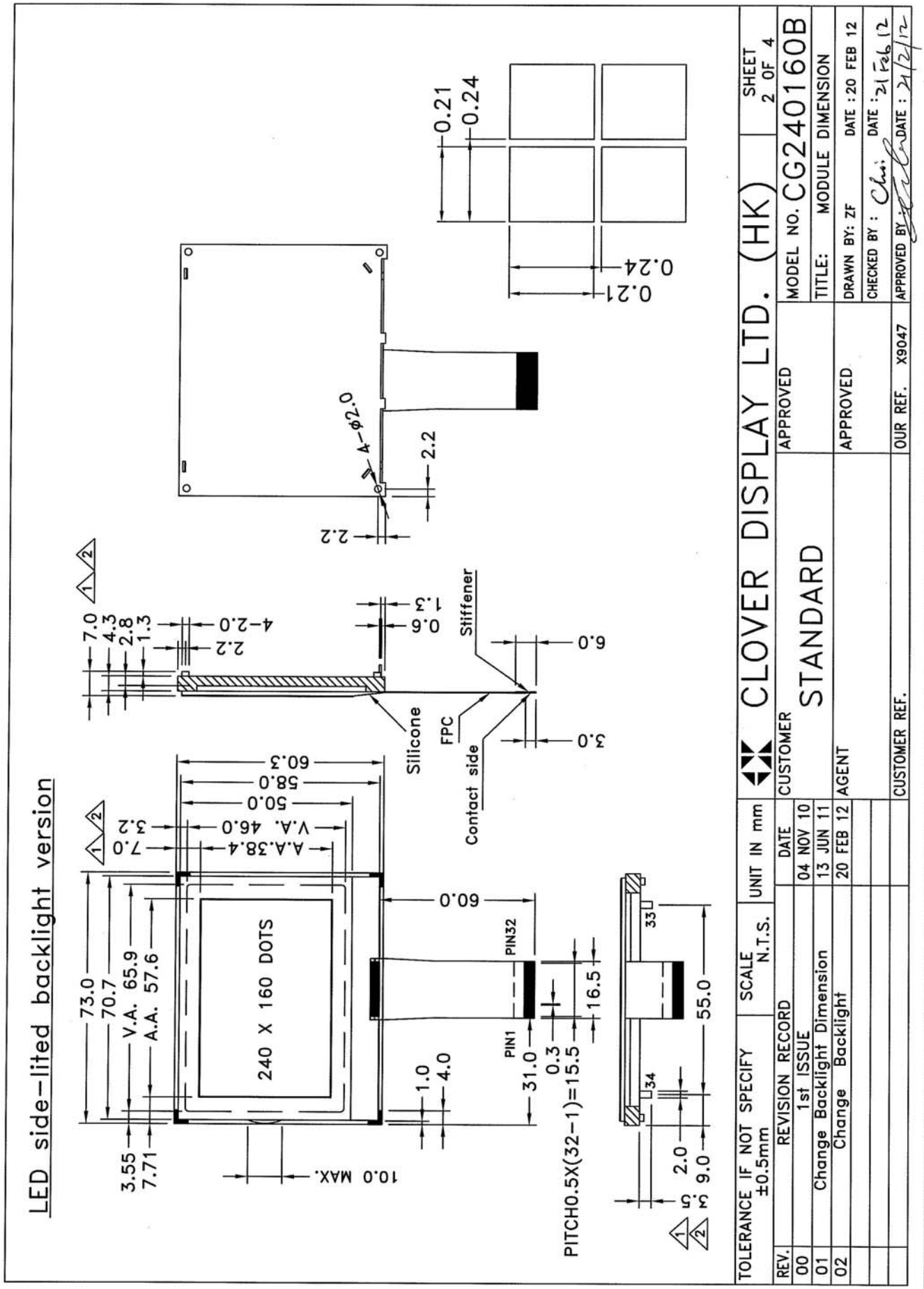
CONNECTOR PIN ASSIGNMENT (CN1)

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	VB0+	LCD bias voltages	18	WR0	Read/write operation control
2	VB1+		19	CD	Register select
3	VB1-		20	CS1	Chip select
4	VB0-		21	CS0	
5	VA0+		22	RST	Reset
6	VA1+		23	D0	Data bus
7	VA1-		24	D1	
8	VA0-		25	D2	
9	VLCD	LCD Power supply	26	D3	
10	VDD	Power supply for logic	27	D4	
11	VDD		28	D5	
12	VSS	Power supply for logic(Ground)	29	D6	
13	VSS		30	D7	
14	ID0	Production control	31	D13	Mode select
15	BM0	Mode select	32	D15	
16	BM1		*33	BL+	Supply voltage for backlight(+VE)
17	WR1	Read/write operation control	*34	BL-	Supply voltage for backlight(-VE)

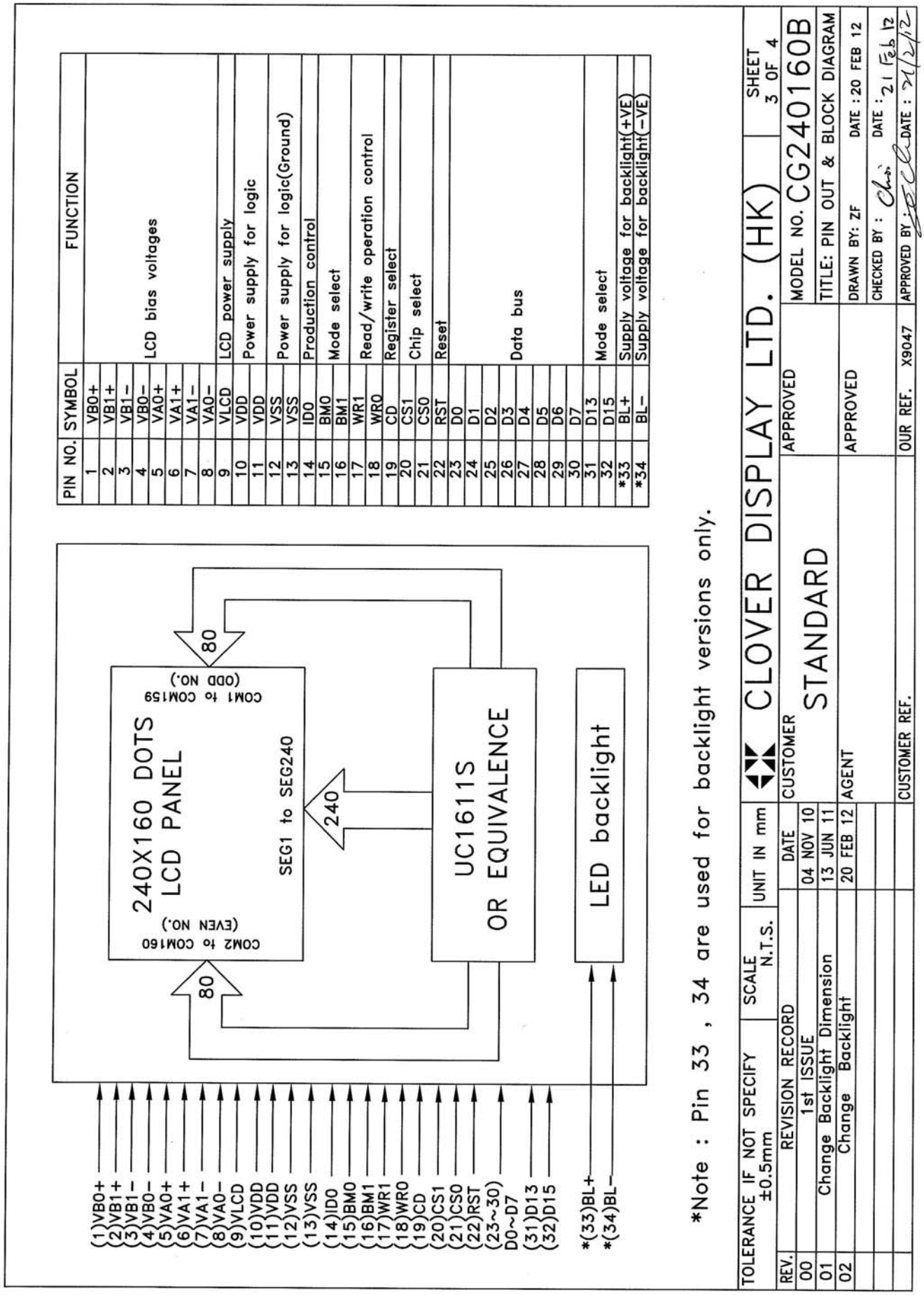
Note (*) : Pin 33, 34 are used for backlight version

COUNTER DRAWING OF MODULE DIMENSION




LED side-lited backlight version
240 X 160 DOTS
V.A. 65.9
A.A. 57.6
73.0
70.7
60.3
58.0
50.0
V.A. 46.0
A.A. 38.4
60.0
PIN1
PIN32
PITCH0.5X(32-1)=15.5
31.0
0.3
16.5
55.0
10.0 MAX.
Silicone
FPC
Contact side
Stiffener
4-φ2.0
0.21
0.24
CLOVER DISPLAY LTD. (HK)
STANDARD
MODEL NO. CG240160B
TITLE: MODULE DIMENSION
DRAWN BY: ZF
CHECKED BY :
APPROVED BY
DATE : 20 FEB 12
DATE : 21 Feb 12
DATE : 24/2/12
SHEET 2 OF 4
UNIT IN mm
SCALE N.T.S.
TOLERANCE IF NOT SPECIFY ±0.5mm
CUSTOMER
AGENT
CUSTOMER REF.
APPROVED
APPROVED
OUR REF. X9047
REV. REVISION RECORD DATE
00 1st ISSUE 04 NOV 10
01 Change Backlight Dimension 13 JUN 11
02 Change Backlight 20 FEB 12

COUNTER DRAWING OF PIN OUT & BLOCK DIAGRAM



PIN NO.	SYMBOL	FUNCTION
1	VB0+	LCD bias voltages
2	VB1+	
3	VB1−	
4	VB0−	
5	VA0+	
6	VA1+	
7	VA1−	
8	VA0−	
9	VLCD	LCD power supply
10	VDD	Power supply for logic
11	VDD	
12	VSS	Power supply for logic(Ground)
13	VSS	
14	IDO	Production control
15	BM0	Mode select
16	BM1	
17	WR1	Read/write operation control
18	WR0	
19	CD	Register select
20	CS1	Chip select
21	CS0	
22	RST	Reset
23	D0	Data bus
24	D1	
25	D2	
26	D3	
27	D4	
28	D5	
29	D6	
30	D7	
31	D13	Mode select
32	D15	
*33	BL+	Supply voltage for backlight(+VE)
*34	BL−	Supply voltage for backlight(−VE)

*Note : Pin 33 , 34 are used for backlight versions 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
00	1st ISSUE	04 NOV 10
01	Change Backlight Dimension	13 JUN 11
02	Change Backlight	20 FEB 12

CUSTOMER — STANDARD — APPROVED

AGENT — APPROVED

CUSTOMER REF. — OUR REF. X9047

MODEL NO. CG240160B

TITLE: PIN OUT & BLOCK DIAGRAM

DRAWN BY: ZF DATE : 20 FEB 12

CHECKED BY : Chris DATE : 21 Feb 12

APPROVED BY : DATE : 21/2/12

ELECTRICAL CHARACTERISTICS

Conditions: VSS=0V, Ta=25℃

Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for Logic	VDD	3.05	3.3	3.55	V
Supply Current for Logic	IDD	–	0.94	1.42	mA
Operating voltage for LCD (*)	VLCD	13.8	14.5	15.2	V
"H"Level Input Voltage	VIH	0.8VDD	–	–	V
"L"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 Backlight:

Constant voltage driving:

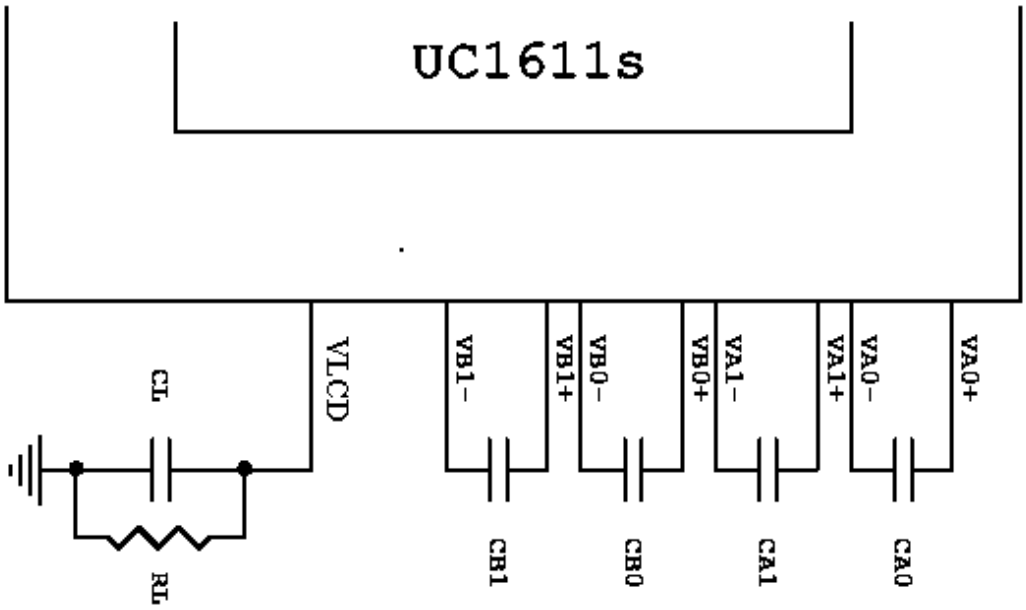
Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
White Backlight current	IBL	–	45	51	mA	VBL = 3.3V
Blue Backlight current	IBL	–	45	51	mA	VBL = 3.3V

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 +0.5	-0.4 to VDD +0.5	V
Operating Temperature	Topr	0 to 50	-20 to 70	℃
Storage Temperature	Tstg	-10 to 60	-30 to 80	℃

REFERENCE CIRCUIT EXAMPLE



CA0,CA1,CB0,CB1=4.7uF

RL=5M,CL=0.1uF

INSTRUCTIONS TABLE

(Note) *: disabled data

The following list of host commands is supported by UC1611s

C/D: 0: Control 1: Data
W/R: 0: Write cycle 1: Read cycle

\# Effective 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	Ver	MX	MY	WA	DE	WS	MD	MS	Get Status	N/A
				ID[1:0]		PMO[5:0]							
				Product Code				0	0	0	EF		
4.	Set Column Addr. LSB	0	0	0	0	0	0	#	#	#	#	Set CA[3:0]	0
	Set Column Addr. MSB	0	0	0	0	0	1	#	#	#	#	Set CA[7:4]	0
5.	Temp. Compensation.	0	0	0	0	1	0	0	1	#	#	Set TC[1:0]	00b: -0.05%/°C
6.	Set Panel Loading	0	0	0	0	1	0	1	0	#	#	Set PC [1:0]	11b: 33~55 nF
7.	Set Pump Control	0	0	0	0	1	0	1	1	#	#	Set PC [3:2]	11b
8.	Set Adv. Program Control (double-byte command)	0	0	0	0	1	1	0	0	R	R	Set APC[R][7:0] R = 0~3	N/A
				#	#	#	#	#	#	#	#		
9.	Set Scroll Line LSB	0	0	0	1	0	0	#	#	#	#	Set SL[3:0]	0
	Set Scroll Line MSB			0	1	0	1	#	#	#	#	Set SL[7:4]	0
10.	Set Page Address LSB	0	0	0	1	1	0	#	#	#	#	Set PA[3:0]	0
	Set Page Address MSB			0	1	1	1	0	#	#	#	Set PA[6:4]	0
11.	Set Potentiometer (double-byte command)	0	0	1 #	0 #	0 #	0 #	0 #	0 #	0 #	1 #	Set PM[7:0]	PM=EAH
12.	Set Isolation Clock Front	0	0	1	0	0	0	0	0	1	0	Set ISOF[3:0]	1H
				0	0	0	1	0	0	1	1		
				-	-	-	-	#	#	#	#		
13.	Set Isolation Clock Back	0	0	1	0	0	0	0	0	1	0	Set ISOB[3:0]	0H
				0	0	0	1	0	1	0	0		
				-	-	-	-	#	#	#	#		
14.	Set Partial Display Control	0	0	1	0	0	0	0	1	#	#	Set LC[9:8]	00b: Disable
15.	Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]	001b
16.	Set Fixed Lines	0	0	1	0	0	1	#	#	#	#	Set FL[3:0]	0
17.	Set Line Rate	0	0	1	0	1	0	0	0	#	#	Set LC[5:4]	10b:28klps
18.	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]	0
19.	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]	0
20.	Set Display Enable	0	0	1	0	1	0	1	#	#	#	Set DC[4:2]	110b
21.	Set LCD Mapping Control (double-byte command)	0	0	1	1	0	0	0	0	0	0	Set LC[3:0]	0
				0	0	0	0	#	#	#	#		
22.	Set N-line Inversion (double-byte command)	0	0	1	1	0	0	1	0	0	0	Set NIV[6:0]	00H
				-	#	#	#	#	#	#	#		
23.	Set Display Pattern	0	0	1	1	0	1	0	#	#	#	Set DC[7:5]	000b
24.	System Reset	0	0	1	1	1	0	0	0	1	0	System Reset	N/A
25.	NOP	0	0	1	1	1	0	0	0	1	1	No operation	N/A
26.	Set test control (double-byte command)	0	0	1	1	1	0	0	1	TT		For testing only. Do not use.	N/A
		0	0	#	#	#	#	#	#	#	#		
27.	Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]	10b: 11
28.	Set COM End	0 0	0 0	1 #	1 #	1 #	1 #	0 #	0 #	0 #	1 #	Set CEN[7:0]	159
29.	Set Partial Display Start	0 0	0 0	1 #	1 #	1 #	1 #	0 #	0 #	1 #	0 #	Set DST[7:0]	0
30.	Set Partial Display End	0 0	0 0	1 #	1 #	1 #	1 #	0 #	0 #	1 #	1 #	Set DEN[7:0]	159

	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action		Default
31.	Set Window Program Starting Column Address	0	0	1	1	1	1	0	1	0	0	Shared with MTP Commands	Set WPC0	0
				#	#	#	#	#	#	#	#			
32.	Set Window Program Starting Row Address	0	0	1	1	1	1	0	1	0	1		Set WPP0	0
				-	-	#	#	#	#	#	#			
33.	Set Window Program Ending Column Address	0	0	1	1	1	1	0	1	1	0		Set WPC1	255
				#	#	#	#	#	#	#	#			
34.	Set Window Program Ending Column Address	0	0	1	1	1	1	0	1	1	1		Set WPP1	79
				-	-	#	#	#	#	#	#			
35.	Window Program Mode	0	0	1	1	1	1	1	0	0	#	Set AC[3]		0:Inside
36.	Set MTP Operation Control	0	0	1	0	1	1	1	0	0	0	Set MTPC[5:0]		10H
				-	-	#	#	#	#	#	#			
37.	Set MTP Write Mask	0	0	1	0	1	1	1	0	0	1	Set MTPM[5:0]		0
				-	-	#	#	#	#	#	#			
38.	Set V_{MTP1} Potentiometer	0	0	1	1	1	1	0	1	0	0	Shared with Window Program Commands	Set MTP1	N/A
				#	#	#	#	#	#	#	#			
39.	Set V_{MTP2} Potentiometer	0	0	1	1	1	1	0	1	0	1		Set MTP2	N/A
				#	#	#	#	#	#	#	#			
40.	Set MTP Write Timer	0	0	1	1	1	1	0	1	1	0		Set MTP3	N/A
				#	#	#	#	#	#	#	#			
41.	Set MTP Read Timer	0	0	1	1	1	1	0	1	1	1		Set MTP4	N/A
				#	#	#	#	#	#	#	#			
SERIAL READ COMMAND (ENABLE IN S8 OR S9 BUS MODES ONLY)														
42.	Get Status	0	0	1	1	1	1	1	1	1	0	Get Status till Chip Disable		N/A
		-	1	Ver	MX	MY	WA	DE	WS	MD	MS			
				ID[1:0]		PMO[5:0]								
				Product Code				0	0	0	EF			

Notes:

- All bit patterns other than commands listed above may result in undefined behavior.
- Commands (38)~(41) are shared with commands (31)~(34), and have exactly the same code. When MTPC[3]=0, commands (37)~(41) are interpreted as Window Programming commands. When MTPC[3]=1, they are MTP Control commands.
- MTPM and PM are actually the same register. Only one of the commands (36) is valid at any time, and it is determined by MTPC[3].
- After MTP-ERASE or MTP-PROGRAM operation, please always perform the following steps,
  a) Disconnect TST4 power source.
  b) Do a full V_{DD} ON-OFF cycle (make sure V_{DD} drops below 50mV).
  before resuming normal operation.

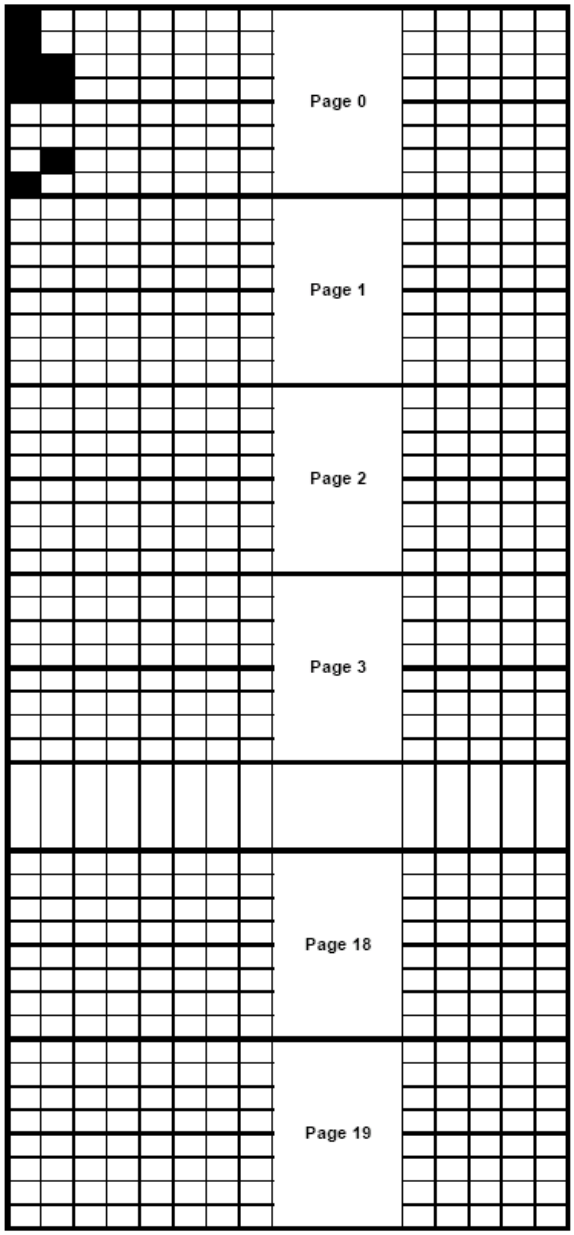
RECOMMENDED INITIAL SETTINGS

System Reset: E2H
Set Temp. Compensation : 24H
Set up LCD format specific parameters MX,MY,etc(double-byte command): C0H,04H
Set line rate : A3H
Set Pump Control (internal Vlcd): 2FH
Set Isolation Clock Front(3 bytes command) : 82H,13H,01H
Set Isolation Clock Back(3 bytes command) : 82H,14H,00H
Set LCD Bias Ratio: EAH
LCD Specific Operation Voltage Setting(double-byte command): 81H , 90H
Set RAM Address Control : 80H
Set Page Addr. MSB: 72H
Set Page Addr. LSB : 60H
Set Column Addr. LSB: 00H
Set Column Addr.MSB: 10H
Window Program Enable : F8H
Window Starting Column(double-byte command) : F4H , 00H
Window Ending Column(double-byte command) : F6H, EFH
Set one bit for one pixel : D1H
Set Display Enable : A9H

DISPLAY DATA RAM

MSF 0	MSF 1	Line Adderss
D0	D4	00H
D1	D5	01H
D2	D6	02H
D3	D7	03H
D4	D0	04H
D5	D1	05H
D6	D2	06H
D7	D3	07H
D0	D4	08H
D1	D5	09H
D2	D6	0AH
D3	D7	0BH
D4	D0	0CH
D5	D1	0DH
D6	D2	0EH
D7	D3	0FH
D0	D4	10H
D1	D5	11H
D2	D6	12H
D3	D7	13H
D4	D0	14H
D5	D1	15H
D6	D2	16H
D7	D3	17H
D0	D4	18H
D1	D5	19H
D2	D6	1AH
D3	D7	1BH
D4	D0	1CH
D5	D1	1DH
D6	D2	1EH
D7	D3	1FH
D0	D4	90H
D1	D5	91H
D2	D6	92H
D3	D7	93H
D4	D0	94H
D5	D1	95H
D6	D2	96H
D7	D3	97H
D0	D4	98H
D1	D5	99H
D2	D6	9AH
D3	D7	9BH
D4	D0	9CH
D5	D1	9DH
D6	D2	9EH
D7	D3	9FH

RAM



MY=0 SL=0	MY=0 SL=16	MY=1 SL=0	MY=1 SL=16
COM1	COM145	COM160	COM16
COM2	COM146	COM159	COM15
COM3	COM147	COM158	COM14
COM4	COM148	COM157	COM13
COM5	COM149	COM156	COM12
COM6	COM150	COM155	COM11
COM7	COM151	COM154	COM10
COM8	COM152	COM153	COM9
COM9	COM153	COM152	COM8
COM10	COM154	COM151	COM7
COM11	COM155	COM150	COM6
COM12	COM156	COM149	COM5
COM13	COM157	COM148	COM4
COM14	COM158	COM147	COM3
COM15	COM159	COM146	COM2
COM16	COM160	COM145	COM1
COM17	COM1	COM144	COM160
COM18	COM2	COM143	COM159
COM19	COM3	COM142	COM158
COM20	COM4	COM141	COM157
COM21	COM5	COM140	COM156
COM22	COM6	COM139	COM155
COM23	COM7	COM138	COM154
COM24	COM8	COM137	COM153
COM25	COM9	COM136	COM152
COM26	COM10	COM135	COM151
COM27	COM11	COM134	COM150
COM28	COM12	COM133	COM149
COM29	COM13	COM132	COM148
COM30	COM14	COM131	COM147
COM31	COM15	COM130	COM146
COM32	COM16	COM129	COM145
COM145	COM129	COM16	COM32
COM146	COM130	COM15	COM31
COM147	COM131	COM14	COM30
COM148	COM132	COM13	COM29
COM149	COM133	COM12	COM28
COM150	COM134	COM11	COM27
COM151	COM135	COM10	COM26
COM152	COM136	COM9	COM25
COM153	COM137	COM8	COM24
COM154	COM138	COM7	COM23
COM155	COM139	COM6	COM22
COM156	COM140	COM5	COM21
COM157	COM141	COM4	COM20
COM158	COM142	COM3	COM19
COM159	COM143	COM2	COM18
COM160	COM144	COM1	COM17

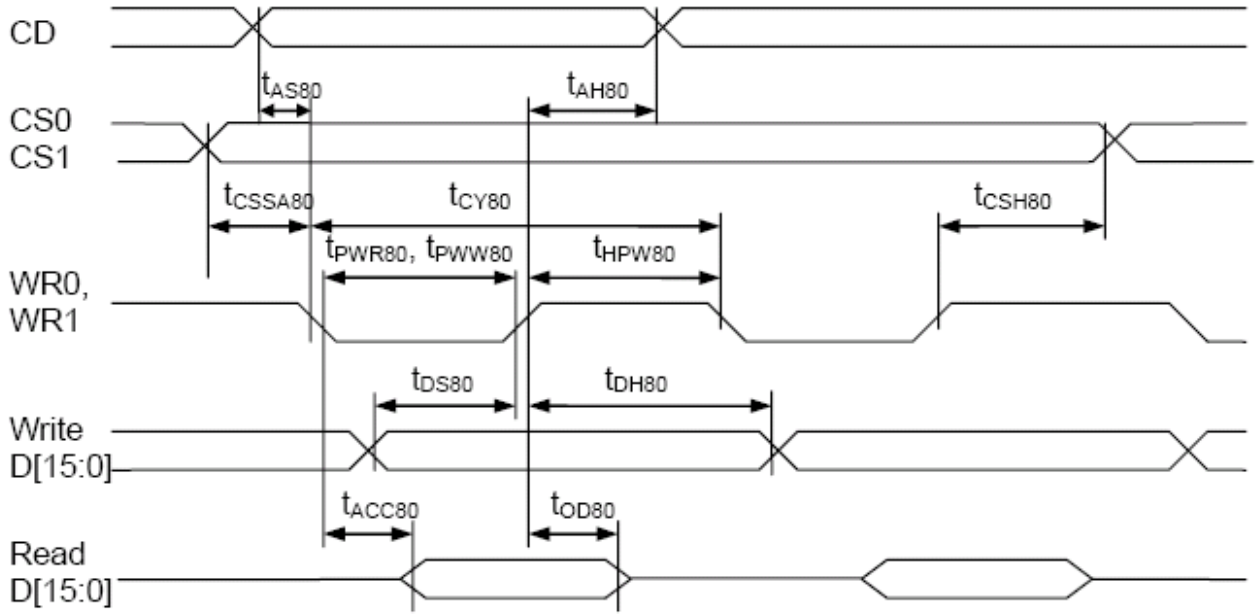
MX														
0	SEG1	SEG2	SEG3	SEG4	SEG5	SEG6	SEG7	SEG8		SEG236	SEG237	SEG238	SEG239	SEG240
1	SEG240	SEG239	SEG238	SEG237	SEG236	SEG235	SEG234	SEG233		SEG5	SEG4	SEG3	SEG2	SEG1

When DC[5:3]=100b :

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

⇒ Page 0 SEG 1 : (D[7:0]) 1000 1111 b
⇒ Page 0 SEG 2 : (D[7:0]) 0100 1100 b

PARALLEL INTERFACE TIMING DIAGRAM (8080 MODE)

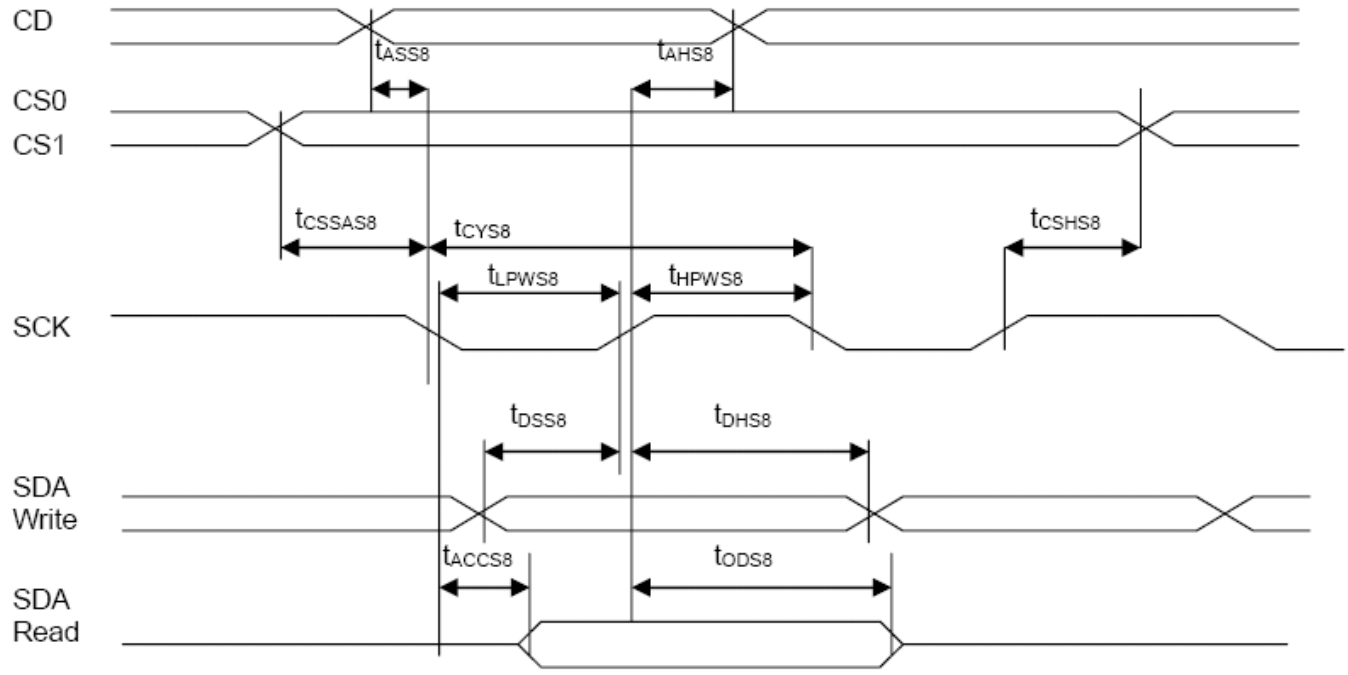


PARALLEL INTERFACE TIMING CHARACTERISTICS(8080 MODE)

($2.5V \leqslant V_{DD} < 3.6V$, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min. (nS)	Max.(nS)
t_{AS80} t_{AH80}	CD	Address setup time Address hold time		0 0	–
t_{CY80}		System cycle time 16-bit bus 8-bit bus 4-bit bus	(Read / Write)	 410 / 330 150 / 130 100 / 70	–
t_{PWR80} t_{PWW80}	WR1, WR0	Low Pulse width 16-bit bus 8-bit bus 4-bit bus	(Read / Write)	 205 / 165 75 / 65 50 / 35	–
t_{HPW80}	WR1, WR0	High pulse width 16-bit bus 8-bit bus 4-bit bus	(Read / Write)	 205 / 165 75 / 65 50 / 35	–
t_{DS80} t_{DH80}	D15~D0	Data setup time Data hold time		30 0	–
t_{ACC80} t_{OD80}		Read access time Output disable time	C_L = 100pF	– 30	60 –
t_{SSA80} t_{CSH80}	CS1/CS0	Chip select setup time		0 0	

SERIAL INTERFACE TIMING DIAGRAM (FOR S8)

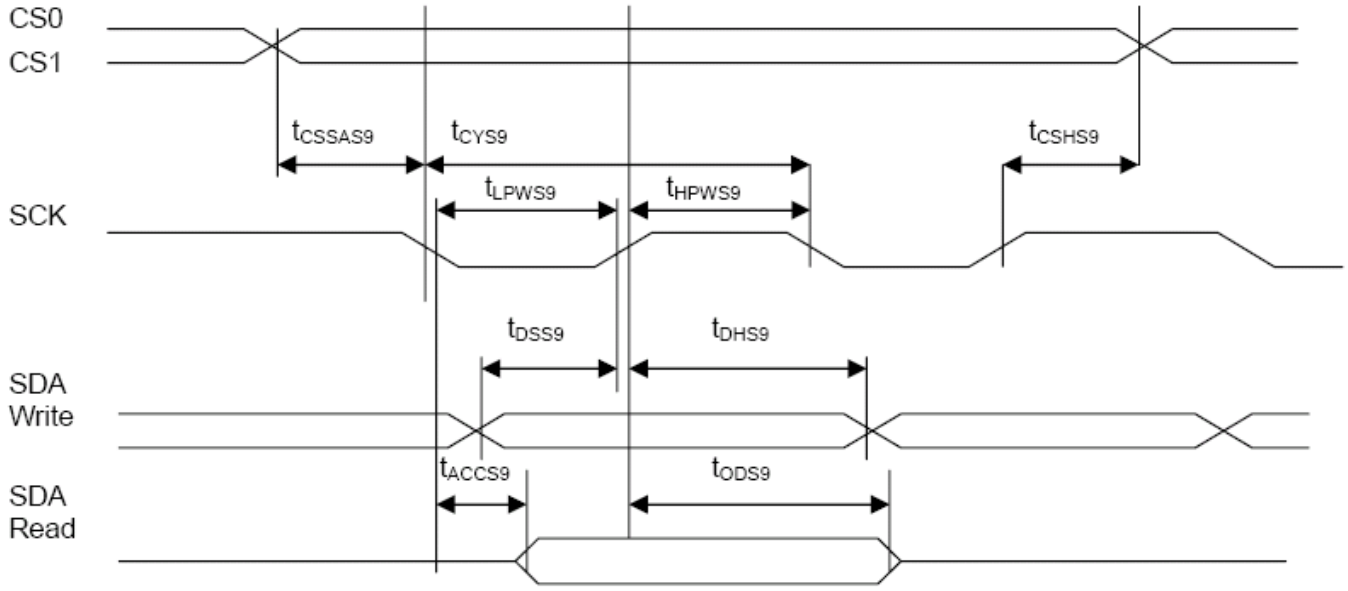


SERIAL INTERFACE TIMING CHARACTERISTICS (FOR S8)

($2.5V \leqslant V_{DD} < 3.6V$, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min. (nS)	Max. (nS)
t_{ASS8} t_{AHS8}	CD	Address setup time Address hold time		0 0	– –
t_{CYS8} t_{LPWS8} t_{HPWS8}	SCK	System cycle time Low pulse width High pulse width	(Read / Write)	120 / 36 60 / 18 60 / 18	– – –
t_{ACCS8} t_{ODS8}		Read access time Output disable time	(Read)	– 15	50 –
t_{DSS8} t_{DHS8}	SDA	Data setup time Data hold time	(Write)	15 0	– –
t_{CSSAS8} t_{CSHS8}	CS1/CS0	Chip select setup time	(Read / Write)	0 / 0 0 / 0	

SERIAL INTERFACE TIMING DIAGRAM (FOR S8)

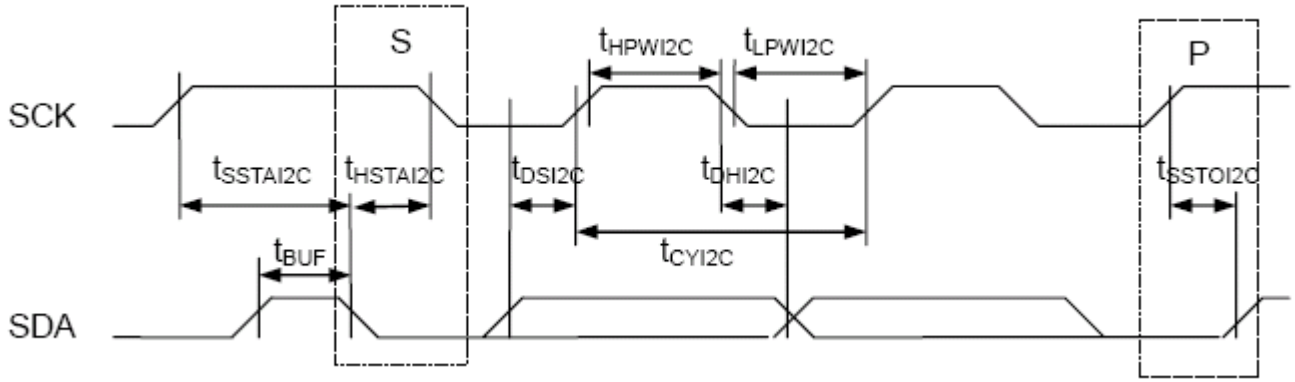


SERIAL INTERFACE TIMING CHARACTERISTICS (FOR S8)

($2.5V \leqslant V_{DD} < 3.6V$, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min. (nS)	Max. (nS)
t_{CYS9} t_{LPWS9} t_{HPWS9}	SCK	System cycle time Low pulse width High pulse width	(Read / Write)	120 / 36 60 / 18 60 / 18	– – –
t_{ACCS9} t_{ODS9}	SDA	Read access time Output disable time	(Read)	– 15	50 –
t_{DSS9} t_{DHS9}	SDA	Data setup time Data hold time	(Write)	15 0	–
t_{CSSAS9} t_{CSHS9}	CS1/CS0	Chip select setup time	(Read / Write)	0 / 0 0 / 0	

SERIAL INTERFACE TIMING DIAGRAM (FOR I²C)

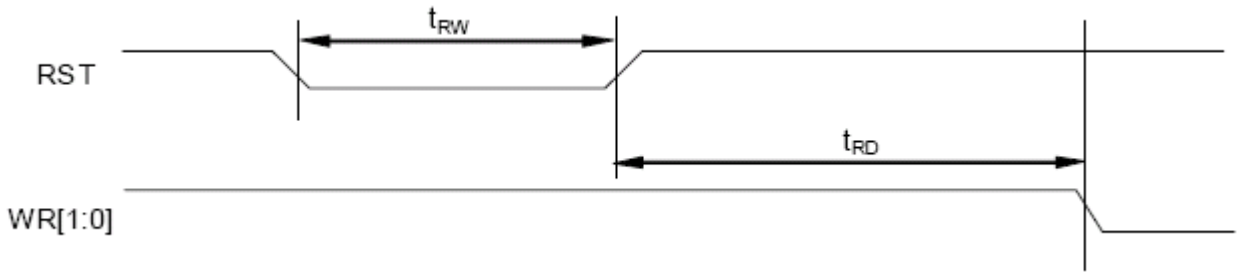


SERIAL INTERFACE TIMING CHARACTERISTICS (FOR I²C)

($2.5V \leqslant V_{DD} < 3.6V$, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min. (nS)	Max. (nS)
t_{CYI2C} t_{LPWI2C} t_{HPWI2C}	SCK	SCK cycle time Low pulse width High pulse width	tr+tf ⩽ 100nS (Read / Write)	580 / 276 290 / 138 290 / 138	–
t_{DSI2C} t_{DHI2C} $t_{SSTAI2C}$ $t_{HSTAI2C}$ $t_{SSTOI2C}$	SCK	Data setup time Data hold time START Setup time START Hold time STOP setup time		33 11 28 50 28	–
t_{BUF}	SDA	Bus Free time between STOP and START condition		165	–

RESET TIMING DIAGRAM



RESET TIMING

($1.65V \leqslant V_{DD} < 3.6V$, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.
t_{RW}	RST	Reset low pulse width		3 μS	–
t_{RD}	RST, WR	Reset to WR pulse delay		10 mS	–

ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = VOP / 64 Hz
TEMPERATURE = 23 ± 5 °C
RELATIVE HUMIDITY = 60 ± 20 %

ITEM	SYMBOL	UNIT	TYP. STN
RESPONSE TIME	Ton	ms	320
	Toff	ms	430
CONTRAST RATIO	Cr	-	8
VIEWING ANGLE (Cr ≥ 2)	V3:00	°	40
	V6:00	°	55
	V9:00	°	40
	V12:00	°	35

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

1.0	**Sampling Method**		
	Sampling Plan : MIL STD 105 E Class of AQL : Level II/Single Sampling Critical : 0.25% Major 0.65% Minor 1.5%		
2.0	**Defect Group**	**Failure Category**	**Failure Reasons**
	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) ≤ 1 / 4 W	MINOR	1
EXCESS SEGMENT	MAX(c,d) ≤ 1 / 4 T	MINOR	1
BUBBLES	d* ≥ 0.2 QTY=0	MINOR	2
BLACKS SPOTS	d ≤ 0.3 N.A.** 0.3<d≤0.4 QTY≤1 0.4<d QTY=0	MINOR	2
LINE SCRATCHES	x≥0.7 y≥0.05 QTY=0	MINOR	3
BLACK LINE	x≥0.7 y≥0.05 QTY=0	MINOR	3

*d = MAX (d_1,d_2) ** N. A . = NOT APPLICABLE DEFECT TABLE : B

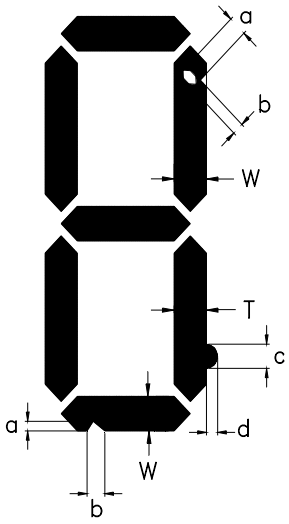
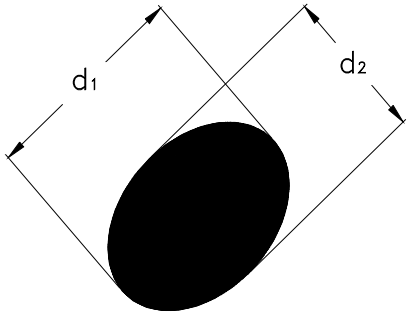
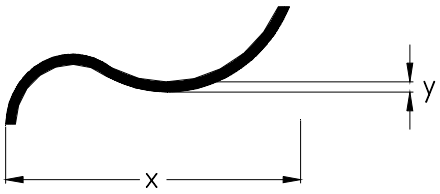


fig . 1



POLARIZER BUBBLES / SPOTS
fig . 2



LINE SCRATCHES / BLACK LINE
fig . 3

QUALITY STANDARD (CONT .)

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

UNLESS STATE OTHERWISE , ALL UNIT ARE IN MILLIMETER . DEFECT TABLE : B

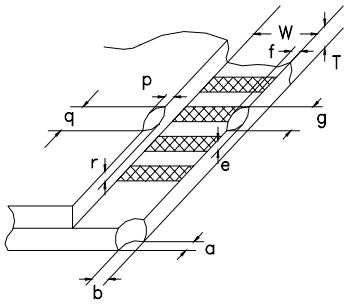


fig . 4

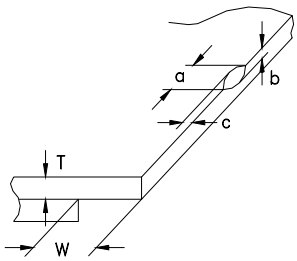


fig . 5

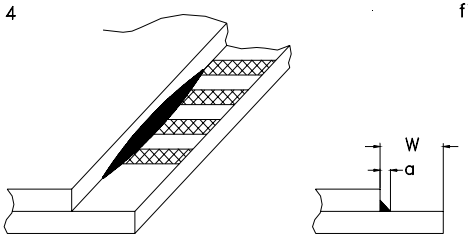


fig . 6

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.
Do not expose to direct sunlight or fluorescent light for a long time

(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 VO.

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.