Crystal Clear Technology

Product Specification

C108x01 series

Crystal Clear Technology sdn. bhd.
16Jalan TP5—Taman Perindustrian Sime UEP
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1.0 Table of Contents

2.0 Record of revision

Rev	Date	Item	Page	Comment	Originator	Checked By
1.0	04/06/08			Initial Release	Syam	Azhar

3.0 General specification

Display format: 1 lines x 8 characters

Character font format: 5 x 8

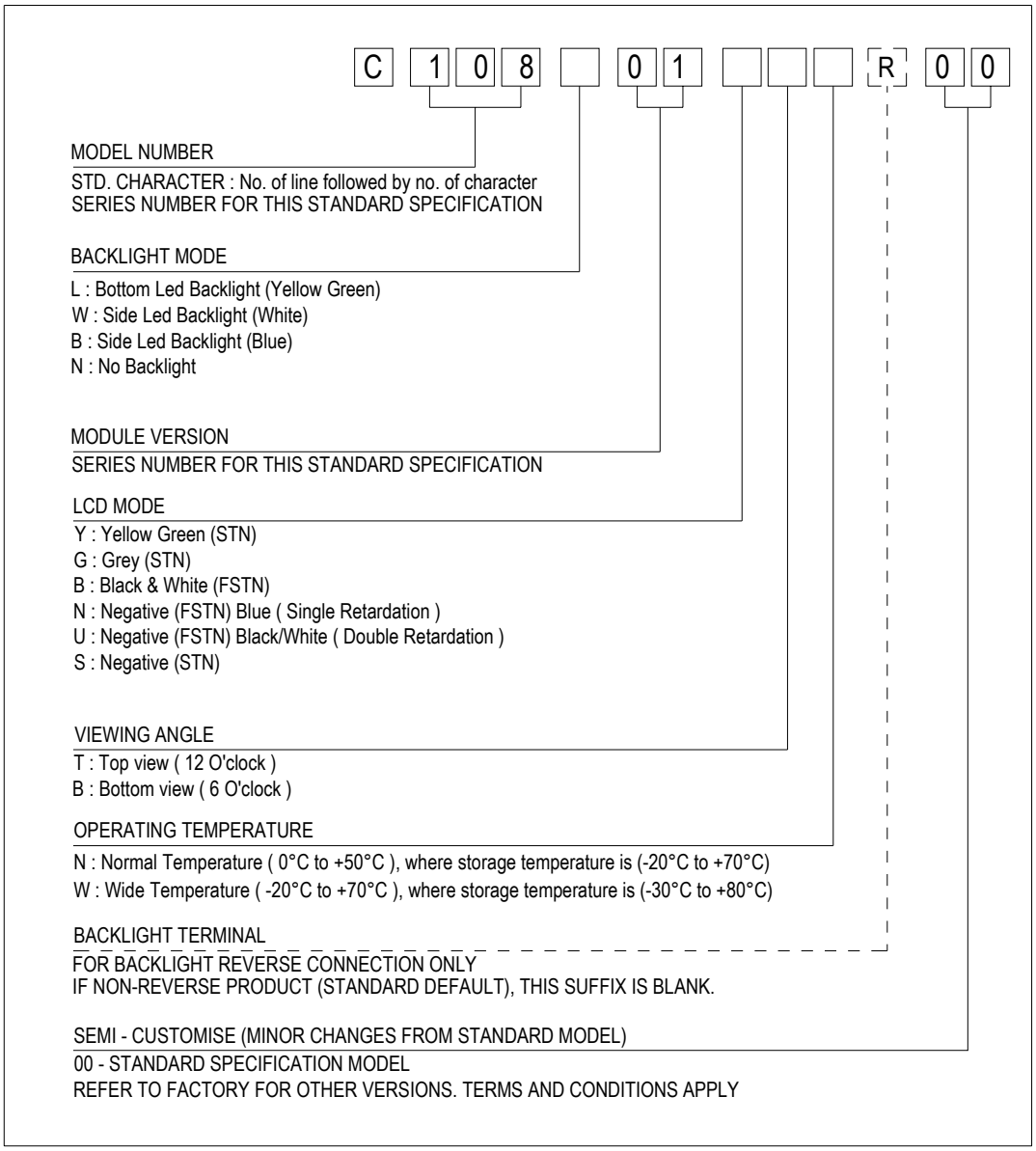
Character size: 6.45mm x 10.75mm

View area: 61.0mm x 15.8mm

Active area: 56.5mm x 10.75mm

General dimensions: 84.0mm x 44.0mm

Controller/Driver: SPLC780 or equivalent



4.0 Absolute maximum rating (at Vss = 0V, ambient temperature = 25°C)

NO	ITEM	SIMBOL	MIN	MAX	UNIT
1.	Power Supply voltage (Logic)	$V_{DD} - V_{SS}$	0	7	V
2.	Power Supply voltage (LCD Driver)	$V_{DD} - V_0$	-	12	V
3.	Operating Temperature	T_{op}	Refer page 3		°C
4.	Storage Temperature	T_{st}	Refer page 3		°C

5.0 Electrical characteristics

NO	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
1.	Power Supply voltage (Logic)	$V_{DD} - V_{SS}$	-	4.5	5.0	5.5	V
2.	Power Supply voltage (V_{LCD})	V_{DD}-V_0	25°C	4.5±5%			V
3.	Input Voltage (except OSC1)	V_{IH}	-	0.7V_{DD}	-	V_{DD}	V
		V_{IL}	-	-0.3	-	0.6	V
4.	Current Supply	I_{DD}	$V_{DD} - V_{SS} = 5V$	-	1.0	2.0	mA

5.1 Backlight Options

NO	COLOR	FORWARD VOLTAGE (V)			FORWARD CURRENT (mA)			MIN BRIGHTNESS (cd/m2) *
		Min	Typ.	Max	Min	Typ.	Max	
1.	Yellow Green	-	4.0	-	-	60	100	60
2.	White	-	3.6	-	-	20	30	20
3.	Blue	-	3.6	-	-	20	30	8

*Note : 1. Brightness measured at backlight surface.
2. On LCD surface, brightness is only about 10% to 15% of backlight brightness.
3. Lifetime of backlight: For YG = 50K hrs. For White, Blue = 20K hrs

6.0 Environmental requirements

NO	ITEM	CONDITION
1.	Operating Temperature	Refer page 3
2.	Storage Temperature	Refer page 3
3.	Operating Humidity	5% to 95%RH
4.	Cycle Test	-20 ºC @ 30 min to 70 ºC @ 30min for 1 cycle run for 10 cycles
5.	Lifetime	50000 HOURS (excluding backlight)

Note: The background on LCD has the possibility to be changed in different temperature range.

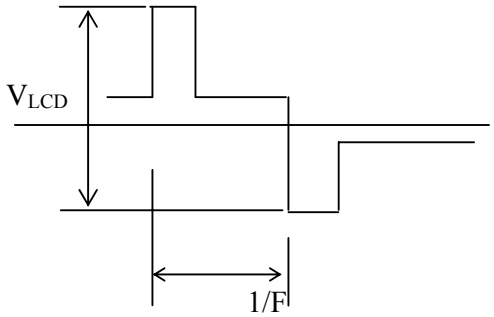
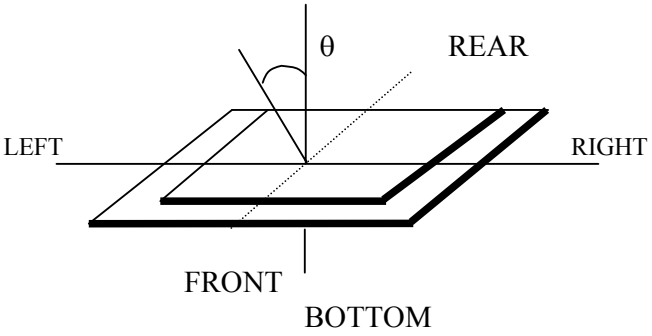
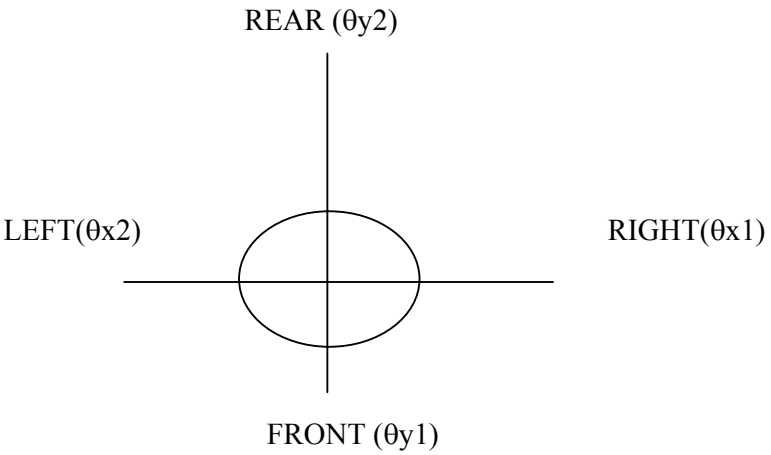
7.0 LCD specification

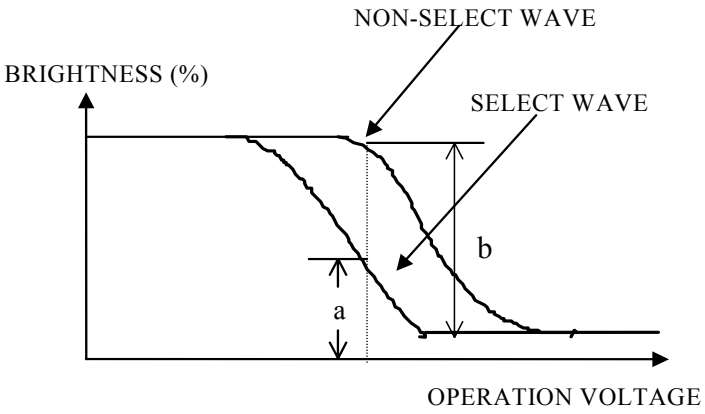
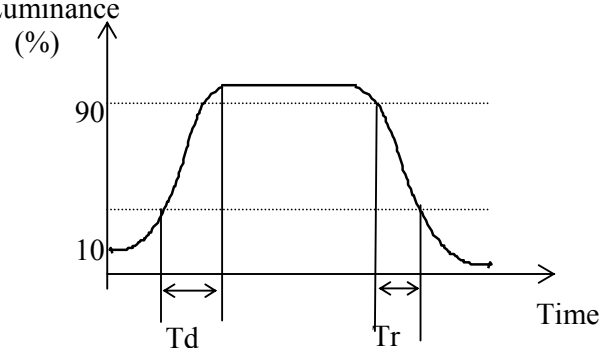
7.1 Electro-optical characteristics (at ambient temperature = 25°C)

NO	ITEM	SYMBOL	CONDITION	LCD TYPE						REF.
				STN YG	STN GREY	STN -VE BLUE	FSTN +VE B/W	FSTN –VE BLUE	FSTN -VE TRUE B/W	
1	Operating Voltage (Volt)	V_{LCD}	θ = 0 Cr = max	4.5 ± 5%						7.1.1
2	Viewing Angle (Deg)	θ x 1	CR ≥ 2 V_{LCD} = 4.5V	+30	+25	+40	+30	+40	+40	7.1.2
		θ x 2		-30	-25	-40	-30	-40	-45	
		θ y 1		-35	-30	-40	-35	-40	-40	
		θ y 2		+35	+30	+40	+35	+40	+40	
3	Contrast Ratio	CR	$\theta = 0^0$ V_{LCD} =4.5V	4.0	2.5	7.0	4.0	7.0	25	7.1.3
4	Response Time (msec)	Rise Time (Tr)	$\theta = 0^0$	150						7.1.4
		Decay Time (Td)	$\theta = 0^0$	150						

Note:

1. Viewing angle data is based on bottom view product by default. Should it be a top view product, values are then swap.
2. Contrast ratio is based on typical data when using white colour as backlight.
3. Equipment Used Eldim; Ez Contrast 120R , Spot Size = 2mm

NO	CHARACTERISTICS	DEFINITIONS
7.1.1	***Definition of Operating Voltage (V_{LCD})***	 V_{LCD} : Operating Voltage F : Frame Frequency
7.1.2	***Definition of Viewing Angle***	 

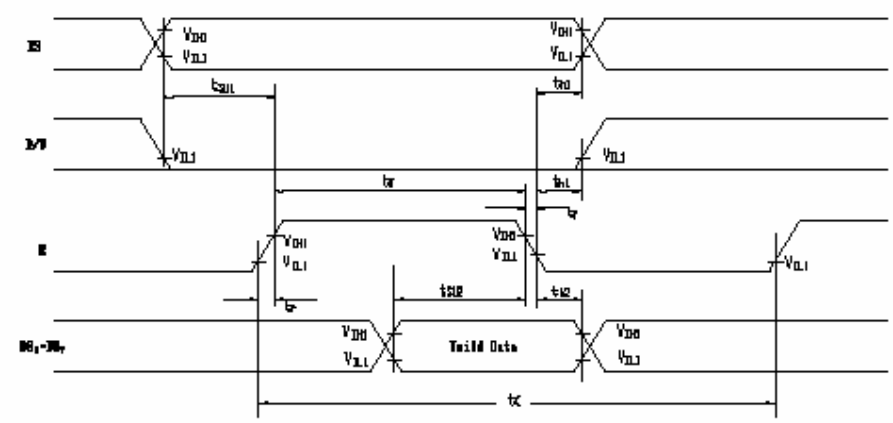
7.1.3	***Definition of Contrast Ratio***	 Contrast Ratio = Brightness of non-selected state (b) / Brightness of selected state (a) ***Conditions*** (a) Operating Voltage: V_{LCD} (b) Temperature: 25°C (c) Viewing Angle, $\theta = 0^o$
7.1.4	*Response Time*	Luminance (%)  Tr: Measured between 10% and 90% of LCD segment maximum response with $V_{ON.}$ Td: With voltage switches to zero and the instant LCD segment reaches 10% of its maximum response.

8.0 Interface

8.1	***Display Driver***	SPLC780	
8.2	***Duty Cycle***	1/8	
8.3	***Pin-out Assignments***		
	Pin No	**Symbol**	**Description**
	1	V_{SS}	Ground terminal of module
	2	V_{DD}	Supply terminal of module
	3	V_O	Power supply for Liquid Crystal Drive
	4	RS	Register Select: RS = 0 …. Instruction Register RS = 1 …. Data Register
	5	R/W	Read/Write: High = Read Low = Write
	6	E	Enable
	7 to 14	D0 to D7	Bi-directional Data Bus. Data Transfer is performed once, thru D0 to D7, in the case of interface data length is 8-bits.
	15	(BL -)	LED power supply terminals
	16	(BL +)	

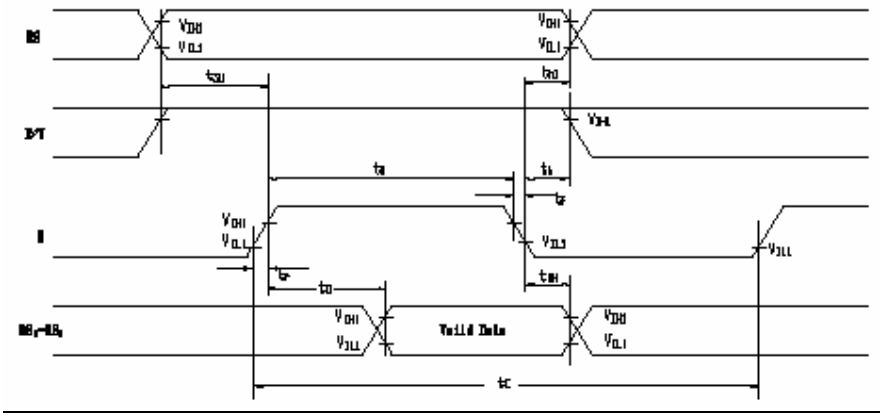
9.0 Timing Characteristics/Timing Diagrams

Characteristic	Symbol	Min.	Typ.	Max.	Unit	Test pin
E cycle time	t_C	500	---	---	ns	E
E rise time	t_r	---	---	25	ns	E
E fall time	t_f	---	---	25	ns	E
E pulse width (High, Low)	t_W	220	---	---	ns	E
R/W and RS set-up time	t_{SU1}	40	---	---	ns	R/W, RS
R/W and RS hold time	t_{h1}	10	---	---	ns	R/W, RS
Data set-up time	t_{SU2}	60	---	---	ns	DB_0~ DB_7
Data hold time	t_{h2}	10	---	---	ns	DB_0~ DB_7



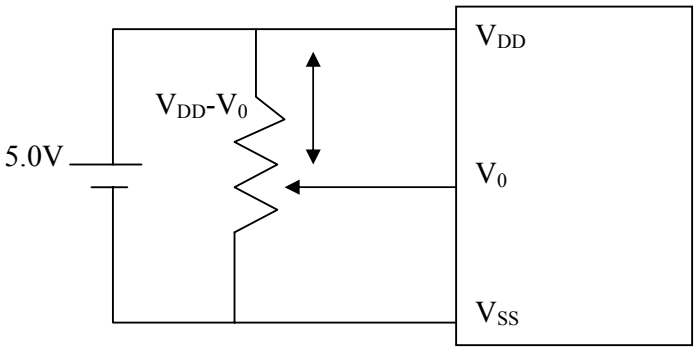
Write mode

Characteristic	Symbol	Min.	Typ.	Max.	Unit	Test pin
E cycle time	t_C	500	---	---	ns	E
E rise time	t_r	---	---	25	ns	E
E fall time	t_f	---	---	25	ns	E
E pulse width	t_W	220	---	---	ns	E
R/W and RS set-up time	t_{SU}	40	---	---	ns	R/W, RS
R/W and RS hold time	t_h	10	---	---	ns	R/W, RS
Data output delay time	t_D	---	---	120	ns	DB_0~ DB_7
Data hold time	t_{DH}	20	---	---	ns	DB_0~ DB_7

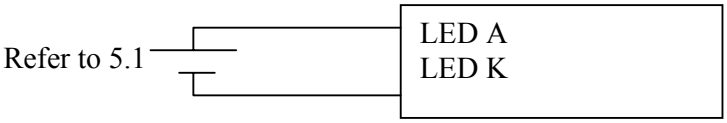


Read mode

10.0 Power Supply



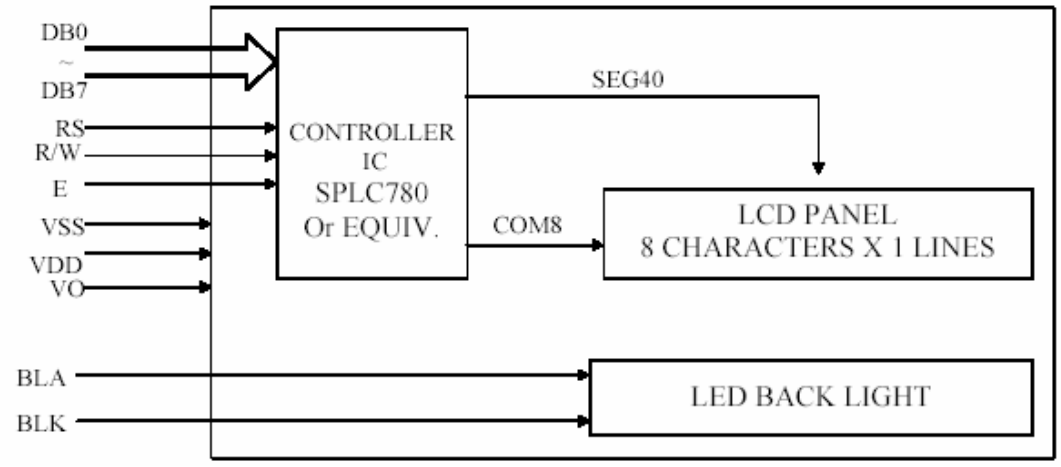
Where V_{DD}-V_0 = LCD Driving voltage



For backlight version only

11.0 Block Diagram

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
VSS	VDD	VO	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	BLA	BLK



12.0 Instructions

Command	RS	R/W	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0	Execution Time (f_{osc} = 250kHz)	Remark
DISPLAY CLEAR	L	L	L	L	L	L	L	L	L	H	1.64ms	
RETURN HOME	L	L	L	L	L	L	L	L	H	X	1.64ms	Cursor move to first digit
ENTRY MODE SET	L	L	L	L	L	L	L	H	I/D	SH	42μs	• I/D : Set cursor move direction I/D: H = Increase; L = Decrease • SH : Specifies shift of display SH: H = Display is shifted; L = Display is not shifted
DISPLAY ON/OFF	L	L	L	L	L	L	H	D	C	B	42μs	• Display D: H = Display on; L = Display off • Cursor C: H = Cursor on; L = Cursor off • Blinking B: H = Blinking on; L = Blinking off
SHIFT	L	L	L	L	L	H	S/C	R/L	X	X	42μs	S/C: H = Display shift; L = Cursor move R/L: H = Right shift; L = Left shift
SET FUNCTION	L	L	L	L	H	DL	N	F	X	X	42μs	DL: H = 8 bits interface; L = 4 bits interface N: H = 2 line display; L = 1 line display F: H = 5 X 10 dots; L = 5 X 7 dots
SET CG RAM ADDRESS	L	L	L	H	CG RAM address (corresponds to cursor address)						42μs	CG RAM Data is sent and received after this setting
SET DD RAM ADDRESS	L	L	H	DD RAM address							42μs	DD RAM Data is sent and received after this setting
READ BUSY FLAG & ADDRESS	L	H	BF	Address Counter used for both DD & CG RAM address							0μs	BF: H = Busy; L = Ready – Reads BF indication internal operating is being performed – Reads address counter contents
WRITE DATA	H	L	Write Data								46μs	Write data into DD or CG RAM
READ DATA	H	H	Read Data								46μs	Read data from DD or CG RAM

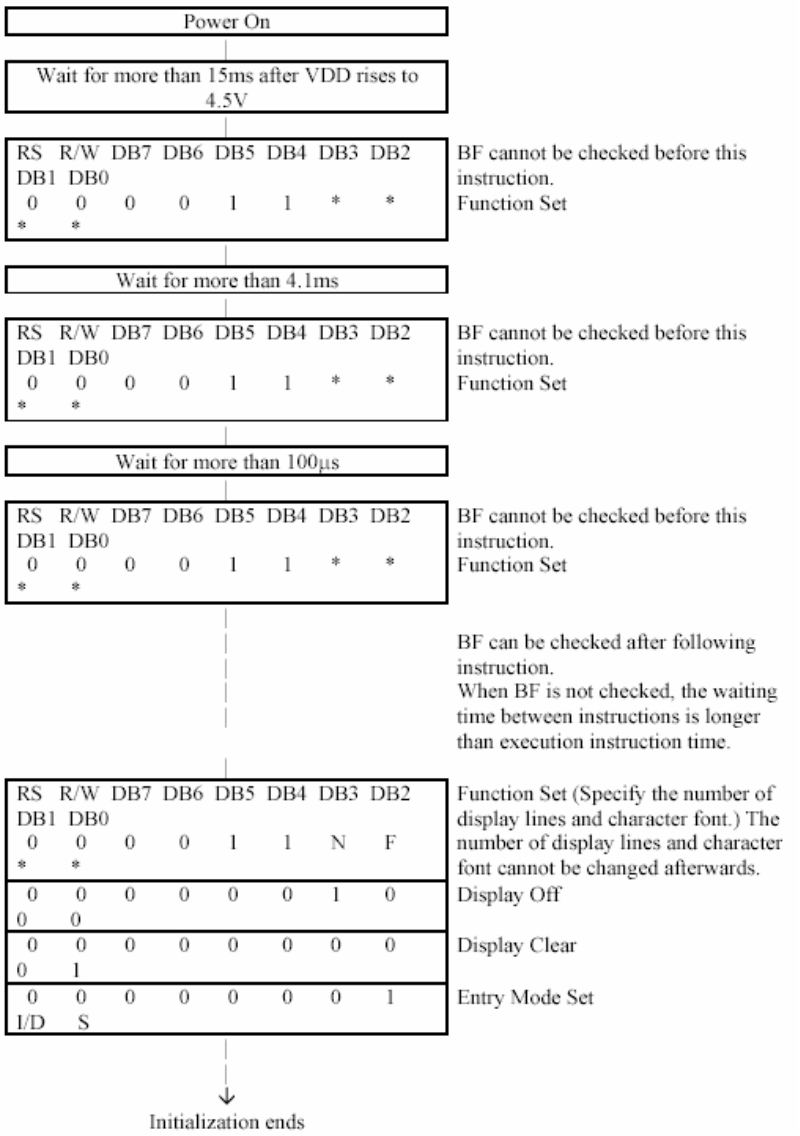
X: Don't care

12.1 Initializing by internal reset circuit

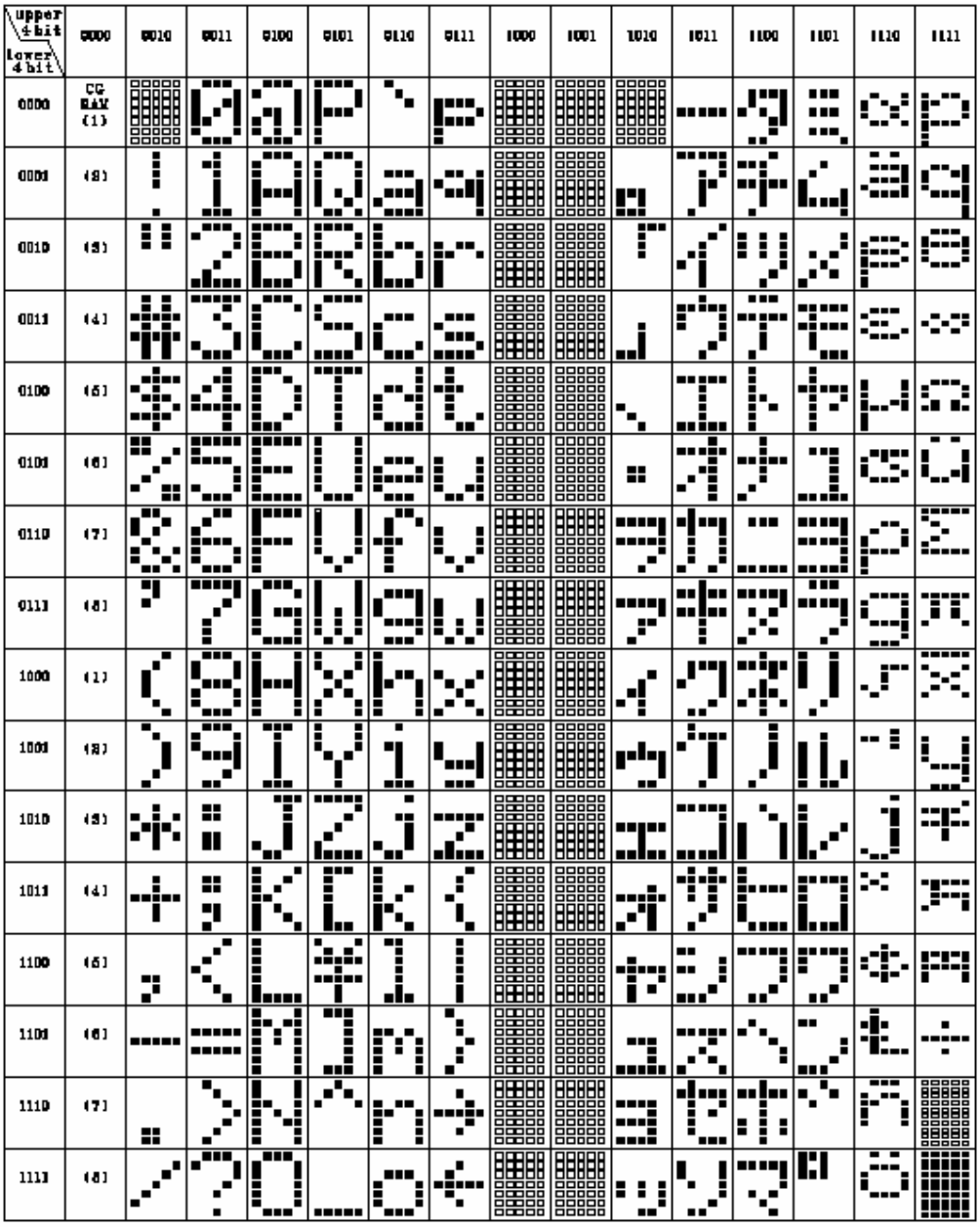
The SPLC780 automatically initializes (resets) when the power is on using the internal reset circuit. The following instructions are executed in initialization. The busy flag is kept in busy state (BF=1) until initialization ends. The busy state is 10ms after VDD rises to 4.5V.

(1) Display Clear
(2) Function Set
    DL = 1: 8-bit interface data
    N = 0: 1-line display
    F = 0: 5x7-dot character font
(3) Display On/Off Control
    D = 0: Display Off
    C = 0: Cursor Off
    B = 0: Blink Off
(4) Entry Mode Set
    I/D = 1: +1 (Increment)
    S = 0: No Shift

12.2 Initializing by instructions



12.3 Character Generator ROM (SPLC780)

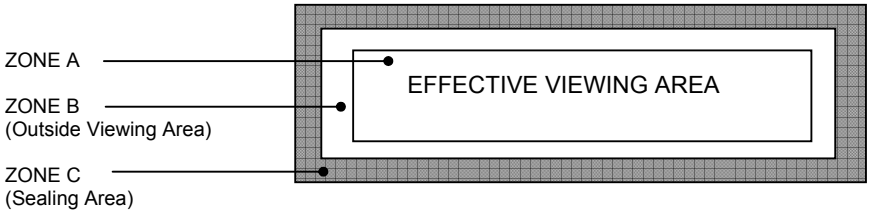


12.4 Display data RAM address map

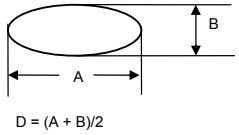
Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
First line	00H	01H	02H	03H	04H	05H	06H	07H	40H	41H	42H	43H	44H	45H	46H	47H

13.0 Quality Assurance

13.1 ZONE DEFINITION



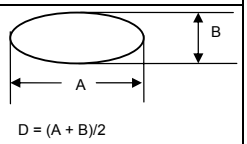
13.1.1 Black Spot, White Spot and Foreign Material

Defect Category	Defect Description	Criterion				Drawing Specification
Black Spot, White Spot and Foreign Material	Black Spot, White Spot and Foreign Material	Zone / Dimension	Acceptable No.			
			A	B	C	
		D ≤ 0.10mm	NC	NC	NC	
		0.10<D ≤ 0.20mm	3	3	NC	
		0.20 < D ≤ 0.30mm	1	2	NC	
		D > 0.30 mm	0	0	NC	
		NC: No count D: Mean Diameter of Defect				

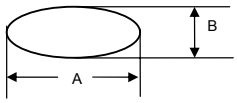
13.1.2 Line Shape and Scratches

Defect Category	Defect Description	Criterion					Drawing Specification
Line shape and scratches	Line shape and scratches	Zone /Dimension		Acceptable No.			
		X	Y	A	B	C	
		-	<0.01mm	NC	NC	NC	
		< 2 mm	< 0.02mm	1	1	NC	
		<1 mm	< 0.0 2mm	1	2	NC	

13.1.3 Pin Hole

Defect Category	Defect Description	Criterion	Drawing Specification
Pin Hole	Pin hole / void at light up segment	D ≤ 0.20mm within 1 part/segment	

13.1.4 Polarizer Bubble/Foreign Material

<table>
<tr><th>Defect Category</th><th>Defect Description</th><th>Criterion</th><th>Drawing Specification</th></tr>
<tr><td></td><td>Polarizer bubble / Foreign material</td><td>
<table>
<tr><td rowspan="2">Zone / Dimension</td><td colspan="3">Acceptable No.</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>D ≤ 0.15mm</td><td>NC</td><td>NC</td><td>NC</td></tr>
<tr><td>0.15 < D ≤ 0.30mm</td><td>3</td><td>5</td><td>NC</td></tr>
<tr><td>0.30 < D ≤ 0.50mm</td><td>2</td><td>3</td><td>NC</td></tr>
<tr><td>0.50 < D ≤ 1.0mm</td><td>0</td><td>1</td><td>NC</td></tr>
<tr><td colspan="4">NC: No count
D: Mean Diameter of Defect
Accept - if air bubble at the seal area does not propagate into effective viewing area</td></tr>
</table>
</td><td> 

D = (A + B)/2</td></tr>
</table>

Note: Total defects shall not exceed five

14. Precaution for using LCM

1. Liquid Crystal Display (LCD)

LCD is made up of glass, organic sealant, organic fluid and polymer based polarizers. The following precautions should be taken when handling.

a) Keep the temperature within the range of use and storage. Excessive temperature and humidity could cause polarization degredation, polarizer peel off or bubble.

b) Do not contact the exposed polarizer with anything harder than HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzin.

c) Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or colour fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.

d) Glass can be easily chipped or cracked from rough handling, especially at corners and edges.

e) Do not drive LCD with DC voltage.

2. Liquid Crystal Display Modules.

2.1 Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modification. The following should be noted.

a) Do not tamper in any way with the tabs on the metal frame.

b) Do not modify the PCB by drilling extra holes, changing its outline, moving its component or modifying its pattern.

c) Do not touch the elastomer connector, especially insert a backlight panel (for example, EL)

d) When mounting a LCM make sure that the PCB is not under any stress such as

e) are very delicate and missing pixels could result from slight dislocation of any of the elements.

f) Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

2.2 Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely

a) The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.

b) The modules should be kept in antistatic bags or other containers to static for storage.

c) Only properly grounded soldering irons should be used.

d) If an electric screwdriver is used, it should be well grounded and shielded from commutator spark.

e) The normal static prevention measures should be observed for work clothes and working benches, the latter conductive (rubber) mat is recommended.

f) Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

2.3 Soldering

a) Solder only to the I/O terminals.

b) Use only soldering irons with proper grounding and no leakage.

c) Soldering temperature: 280 °C

d) Soldering time: 3 to 4 sec

e) Use eutectic solder with resin flux fill.

f) If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed afterwards.

2.4 Operation

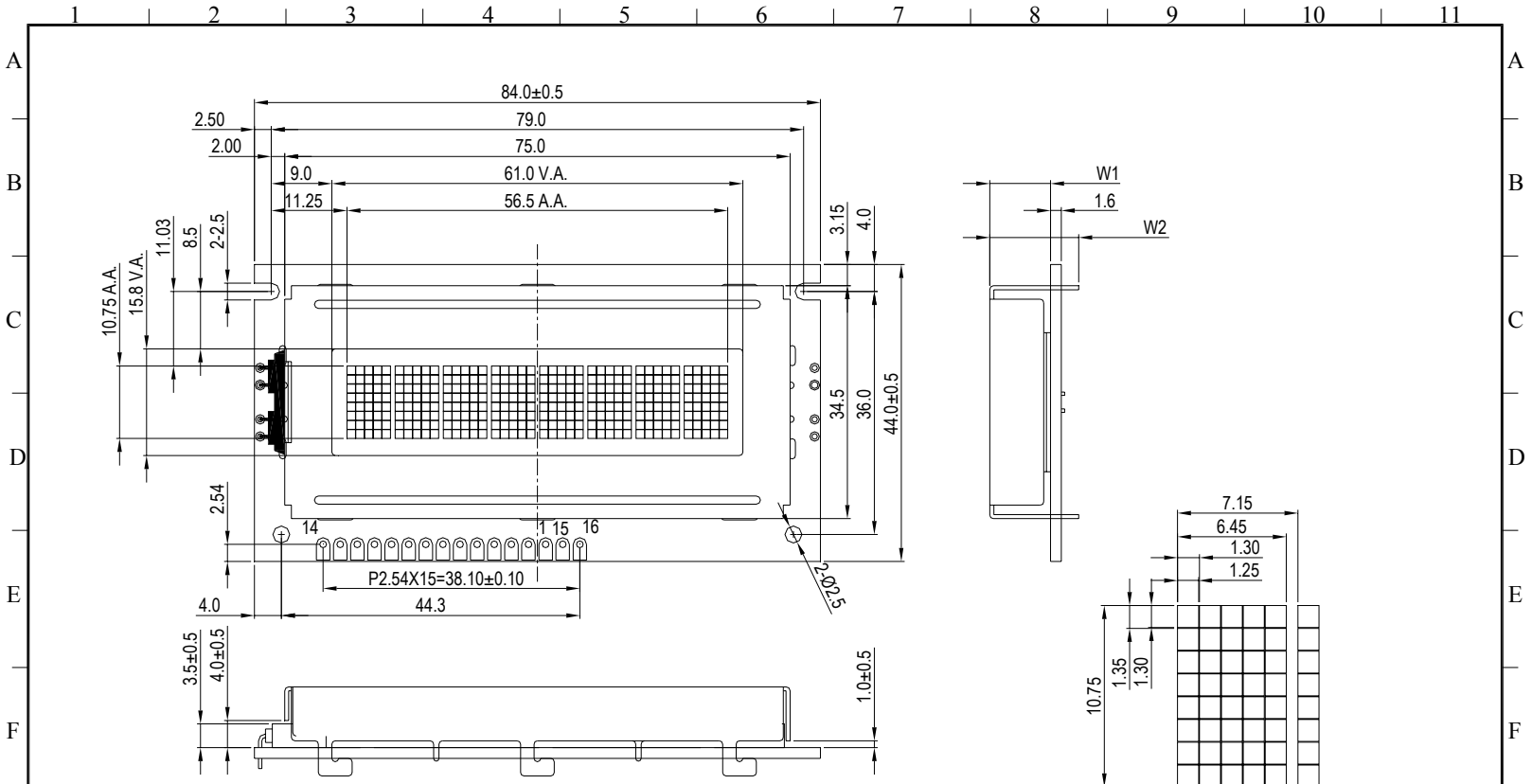
a) The contras can be adjusted by varying the LCD driving voltage V0
b) Driving voltage should be kept within specified range, excess voltage shortens display life.
c) Response time increases with decrease in temperature.
d) Display may turn black or dark blue at temperature above its operational range, this is (however not pressing on the viewing area) may cause the segments to appear "fractured".
e) Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured".

2.5 Storage

If any fluid leaks out of the damage glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

2.6 Limited Warranty

Unless otherwise agreed between Crystal Clear Technology and customer, Crystal Clear Technology will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with Crystal Clear Technology acceptance standards, for a period of one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Crystal Clear Technology is limited to repair and/or replacement on the terms set forth above. Crystal Clear Technology will not responsible for any subsequent or consequential events.



NOTE :-
1. GENERAL TOLERANCE TO BE ±0.3
2. BEZEL : COATING IN BLACK

VERSION	W1	W2
NO/SIDE LED BACKLIGHT	5.80±0.5	10.5 MAX
BOTTOM LED BACKLIGHT	9.00±0.5	14.0 MAX

NO	MODEL NAME	MATERIAL	REMARKS
2			
1			

CRYSTAL CLEAR TECHNOLOGY SDN BHD
16, JLN TP5, TMN PERINDUSTRIAN SIME UEP,
47500 SUBANG JAYA, SELANGOR DARUL EHSAN.

PART NAME: MECHANICAL SPECIFICATION

APPROVED	CHECKED	DRAWN	UNIT : MM	DRAWING NUMBER	SHEET	REV.
		AZHAR 10-06-2008	NTS	C108x01xxx00	1/1	1

Crystal Clear Technology
16 Jalan TP5—Taman Perindustrian Sime UEP
47600 Subang Jaya—Selangor DE
Malaysia