

# Crystal Clear Technology

## Product Specification

### **G32160X02 series**

Crystal Clear Technology sdn. bhd.

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2.0 Record of revision

Rev	Date	Item	Page	Comment	Originator	Checked By
1.0	22/09/08			Initial Release	Syam	Azhar



3.0 General specification

Display format: Graphics 160 (w) x 32 (h) dots

Dot size: 0.42 (w) x 0.45 (h) mm

Dot pitch: 0.47 (w) x 0.50 (h) mm

View area: 80.0 (w) x 20.5 (h) mm

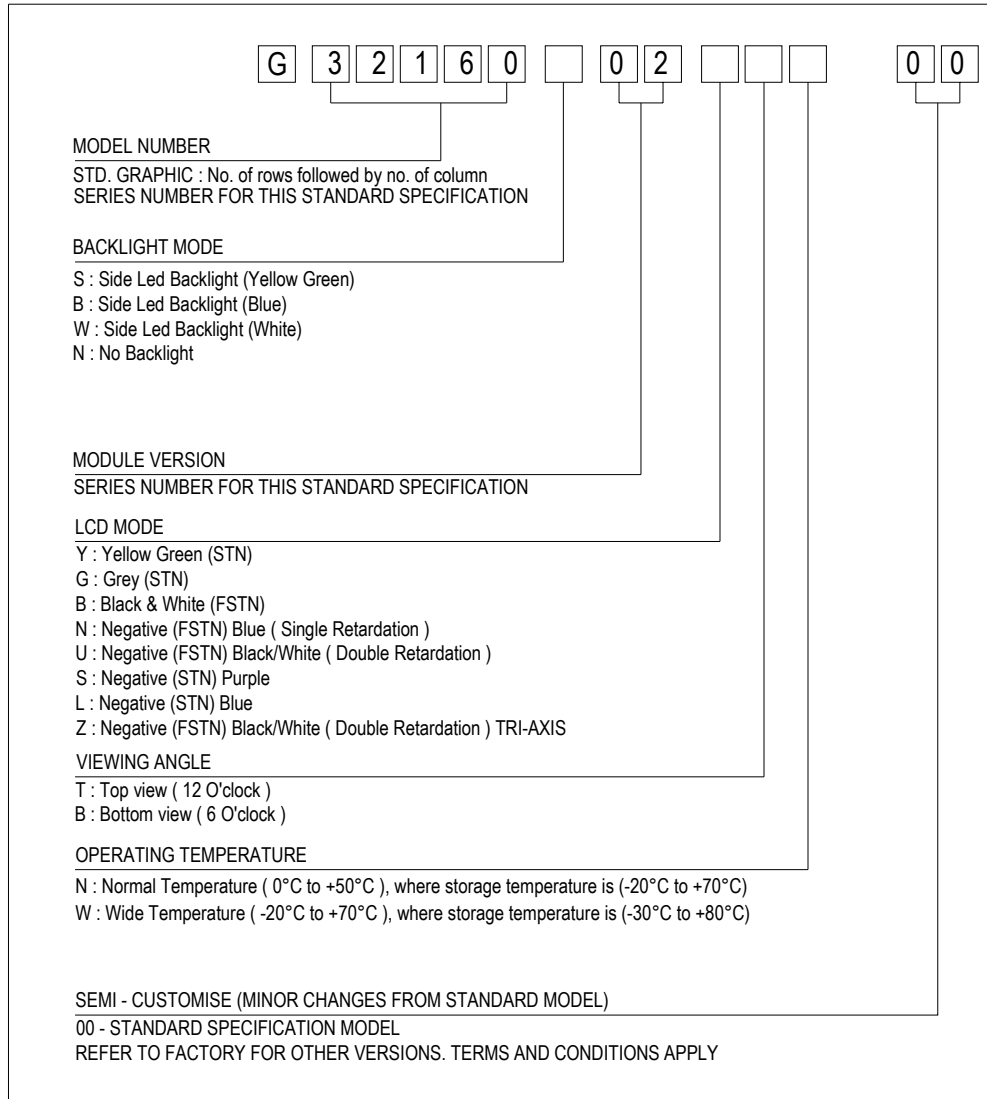
Active area: 75.15 (w) x 15.95 (h) mm

General dimensions: 100.0 (w) x 38.8 (h) x 12.5 max (t) mm

Controller/Driver: SBN1661 and SBN0080 or equivalent

Interface: Parallel

Driving method: 1/32 duty



**4.0 Absolute maximum rating (at V<sub>SS</sub> = 0V, ambient temperature = 25°C)**

NO	ITEM	SIMBOL	MIN	MAX	UNIT
1.	Power Supply Voltage (Logic)	V <sub>DD</sub> - V <sub>SS</sub>	-0.3	7.0	V
2.	Power Supply Voltage (LCD Driver)	V <sub>DD</sub> - V <sub>EE</sub>	-	13.0	V
3.	Operating Temperature	T <sub>op</sub>	Refer page 3		°C
4.	Storage Temperature	T <sub>st</sub>	Refer page 3		°C

**5.0 Electrical characteristics**

NO	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
1.	Power Supply Voltage (Logic)	V <sub>DD</sub> - V <sub>SS</sub>	-	2.4	-	5.5	V
2.	Power Supply Voltage (V <sub>LCD</sub> )	V <sub>DD</sub> -V <sub>EE</sub>	25°C	7.0±5%			V
3.	Input Voltage	V <sub>IH</sub>	-	V <sub>SS</sub> + 2	-	V <sub>DD</sub>	V
		V <sub>IL</sub>		V <sub>SS</sub> + 0.7	-	V <sub>SS</sub> + 1.2	
4.	Current Supply	I <sub>DD</sub>	V <sub>DD</sub> - V <sub>SS</sub> = 5V V <sub>DD</sub> - V <sub>EE</sub> = 5V	-	0.8	1.0	mA

**5.1 Backlight Options**

NO	COLOR	FORWARD VOLTAGE (V)			FORWARD CURRENT (mA)			MIN BRIGHTNESS (cd/m2) *
		Min	Typ.	Max	Min	Typ.	Max	
1.	Green	-	5.0	-	-	35	40	10
2.	Blue	-	5.0	-	-	35	40	10
3.	White	-	5.0	-	-	35	40	40

- \*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 White, Green = 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	0 C @ 30 min to 50 C @ 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

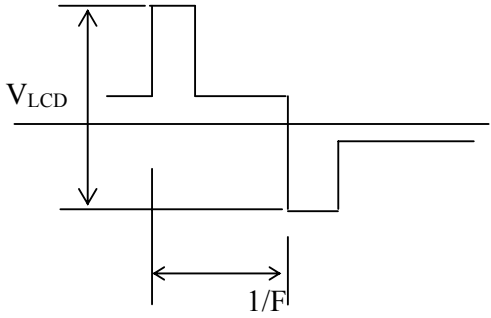
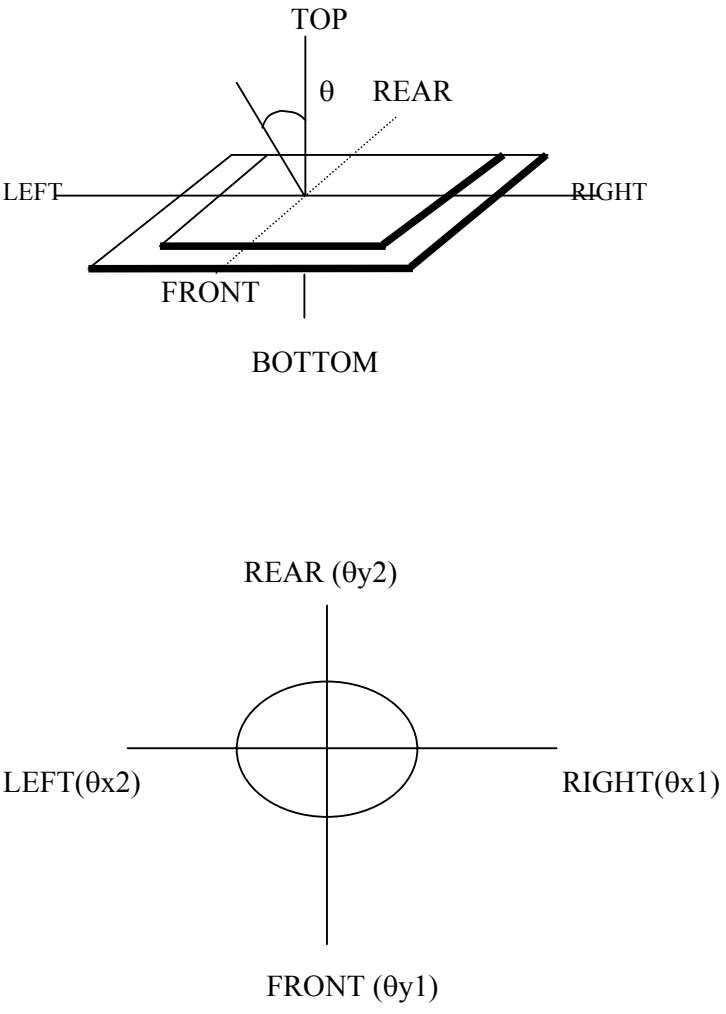
7.1 Electro-optical characteristics (at ambient temperature = 25°C)

NO	ITEM	SYMBOL	CONDITION	LCD TYPE							REF.
				STN YG	STN GREY	STN -VE BLUE/PURPLE	FSTN +VE B/W	FSTN -VE BLUE	FSTN -VE TRUE B/W	FSTN -VE TRI AXIS	
1	Operating Voltage (Volt)	$V_{LCD}$	$\theta = 0$ $Cr = \max$	7.0 ± 5%							7.1.1
2	Viewing Angle (Deg)	$\theta_x 1$	$CR \geq 2$ $V_{LCD} = 14.7V$	+25	+20	+35	+25	+35	+35	+40	7.1.2
		$\theta_x 2$		-25	-20	-35	-25	-35	-40	-40	
		$\theta_y 1$		-30	-25	-35	-30	-35	-35	-50	
		$\theta_y 2$		+30	+25	+35	+30	+35	+35	+30	
3	Contrast Ratio	CR	$\theta = 0^0$ $V_{LCD} = 14.7V$	3.0	2.3	6.0	3.0	6.0	20	20	7.1.3
4	Response Time (msec)	Rise Time (Tr)	$\theta = 0^0$	200							7.1.4
		Decay Time (Td)	$\theta = 0^0$	250							

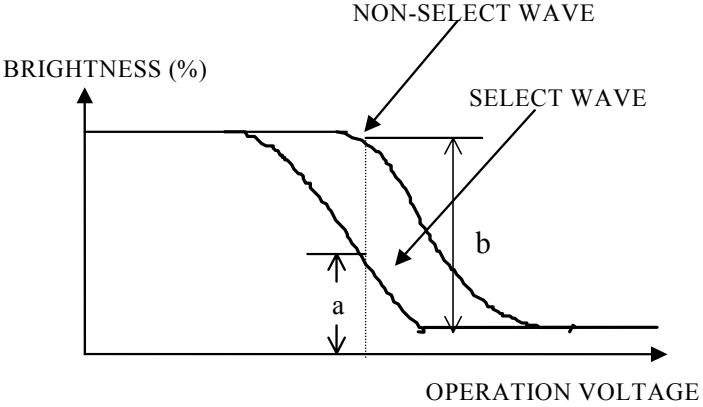
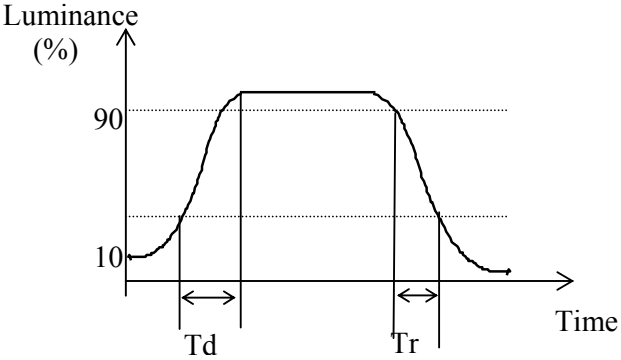
Note:

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	<b>Definition of Operating Voltage (<math>V_{LCD}</math>)</b>	 <p><math>V_{LCD}</math> : Operating Voltage F : Frame Frequency</p>
7.1.2	<b>Definition of Viewing Angle</b>	



<p>7.1.3</p>	<p><b>Definition of Contrast Ratio</b></p>	 <p>Contrast Ratio = <math>\frac{\text{Brightness of non-selected state (b)}}{\text{Brightness of selected state (a)}}</math></p> <p><b>Conditions</b></p> <ul style="list-style-type: none"><li>(a) Operating Voltage: <math>V_{LCD}</math></li><li>(b) Temperature: <math>25^{\circ}C</math></li><li>(c) Viewing Angle, <math>\theta = 0^{\circ}</math></li></ul>
<p>7.1.4</p>	<p><b>Response Time</b></p>	 <p>Tr: Measured between 10% and 90% of LCD segment maximum response with <math>V_{ON}</math>.</p> <p>Td: With voltage switches to zero and the instant LCD segment reaches 10% of its maximum response.</p>



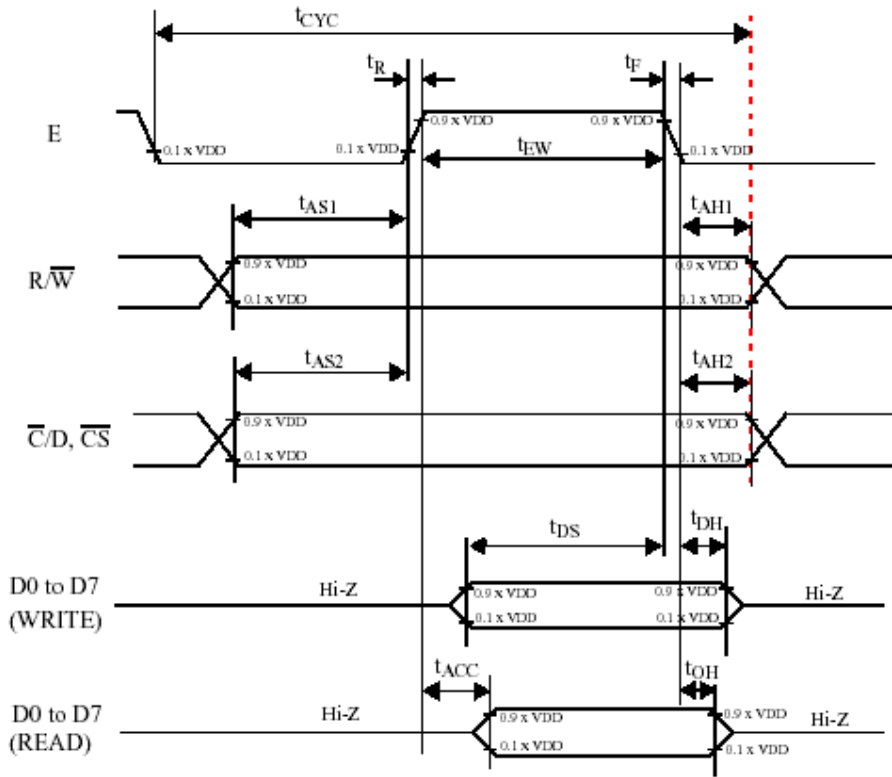
**8.0 Interface**

<b>8.1</b>	<b>Controller</b>	SBN1661 OR EQUIVALENT	
<b>8.2</b>	<b>Display Driver</b>	SBN1661 OR EQUIVALENT	
<b>8.3</b>	<b>Duty Cycle</b>	1/64	
<b>8.4</b>	<b>Pin-out Assignments</b>		
	<b>Pin No</b>	<b>Symbol</b>	<b>Description</b>
	1	V <sub>SS</sub>	Ground terminal of module
	2	V <sub>DD</sub>	Supply terminal of module
	3	V <sub>EE</sub>	Negative Supply Voltage
	4	A0	Select display data / instruction
	5	R/W	Read / Write selection
	6	E3	Chip select IC U2
	7 to 14	DB0 to DB7	Data bus line
	15	NC	No Connection
	16	NC	No Connection
	17	E1	Chip select IC U1
	18	E2	Chip select IC U3
	19	K	Backlight ground
	20	A	Backlight supply



9.0 Functional Descriptions

9.1 Display Control Timing Waveform and Characteristics



$V_{DD} = 5V \pm 10\%$ ;  $V_{SS} = 0V$ ;  $T_{amb} = -20^\circ C$  to  $+75^\circ C$ .

symbol	parameter	min.	max.	test conditons	unit
$t_{AS1}$	Address set-up time with respect to R/W	20			ns
$t_{AS2}$	Address set-up time with respect to C/D, CS	20			ns
$t_{AH1}$	Address hold time with respect to R/W	10			ns
$t_{AH2}$	Address hold time respect with to C/D, CS	10			ns
$t_F, t_R$	Enable (E) pulse falling/rising time		15		ns
$t_{CYC}$	System cycle time	1000		Note 1	ns
$t_{EWR}$	Enable pulse width for READ	100			ns
$t_{EWW}$	Enable pulse width for WRITE	80			ns
$t_{DS}$	Data setup time	80			ns
$t_{DH}$	Data hold time	10			ns
$t_{ACC}$	Data access time		90	CL= 100 pF.	ns
$t_{OH}$	Data output hold time	10	60	Refer to Fig. 23.	ns

Timing Interface with 6800 series MPU



9.2 Relationship between display data RAM locations and address

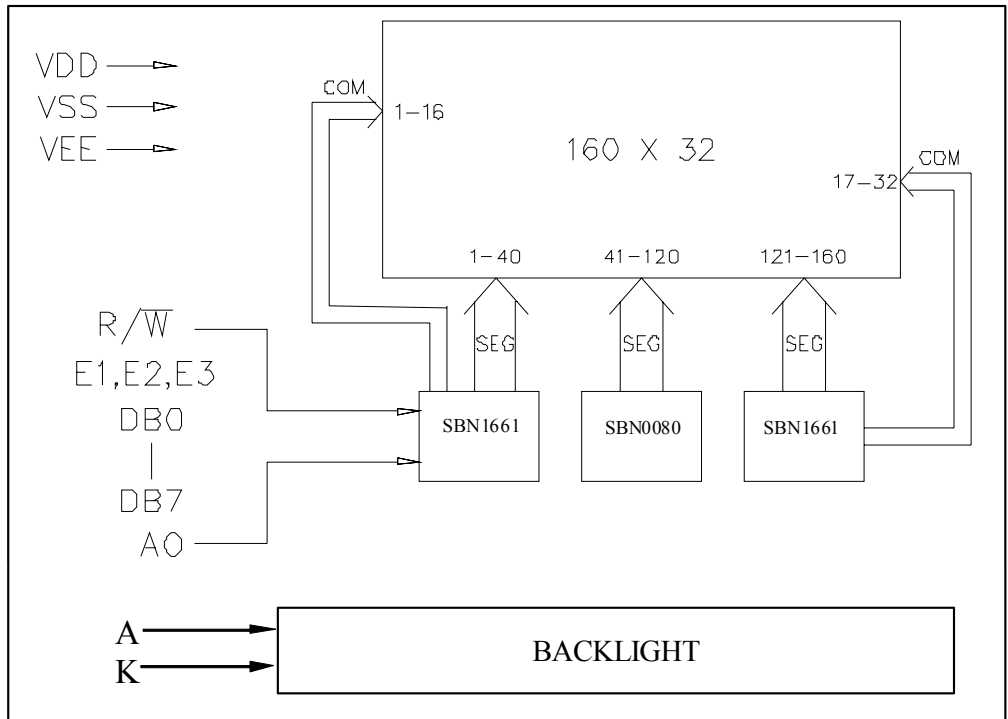
Page 0	Bit0	Column 0(Byte0)	Column 1(Byte1)	Column 2(Byte2)	Column 3(Byte3)	Row0	Column 7(Byte7)	Column 8(Byte8)	Column 9(Byte9)
	Bit1					Row1			
	Bit2					Row2			
	Bit3					Row3			
	Bit4					Row4			
	Bit5					Row5			
	Bit6					Row6			
	Bit7					Row7			
Page 1	Bit0	Row8							
	Bit1	Row9							
	Bit2	Row10							
	Bit3	Row11							
	Bit4	Row12							
	Bit5	Row13							
	Bit6	Row14							
	Bit7	Row15							
Page 2	Bit0	Row16							
	Bit1	Row17							
	Bit2	Row18							
	Bit3	Row19							
	Bit4	Row20							
	Bit5	Row21							
	Bit6	Row22							
	Bit7	Row23							
Page 3	Bit0	Row24							
	Bit1	Row25							
	Bit2	Row26							
	Bit3	Row27							
	Bit4	Row28							
	Bit5	Row29							
	Bit6	Row30							
	Bit7	Row31							

10. Instruction Set

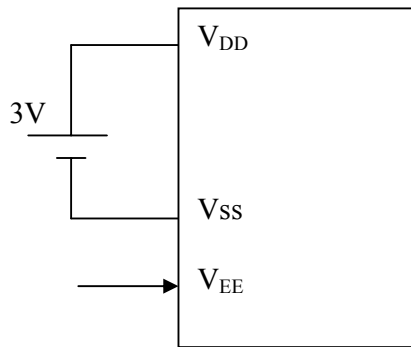
COMMAND	COMMAND CODE								FUNCTION
	D7	D6	D5	D4	D3	D2	D1	D0	
Write Display Data	Data to be written into the Display Data Memory.								Write a byte of data to the Display Data Memory.
Read Display Data	Data read from the Display Data Memory.								Read a byte of data from the Display Data Memory.
Read-Modify-Write	1	1	1	0	0	0	0	0	Start Read-Modify-Write operation.
END	1	1	1	0	1	1	1	0	Stop Read-Modify-Write operation.
Software Reset	1	1	1	0	0	0	1	0	Software Reset.



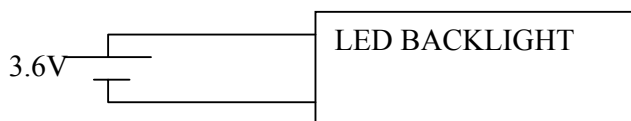
11. Block Diagram and Power Supply



Block Diagram



Where  $V_{DD} - V_{EE}$  = LCD Driving voltage

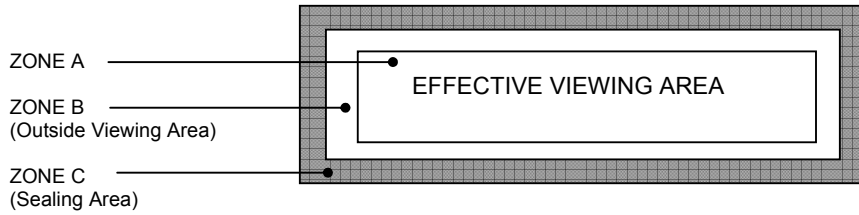


Power Supply



12.0 Quality Assurance

**12.1 ZONE DEFINITION**



12.1.1 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.			<p>D = (A + B)/2</p>
			A	B	C	
		$D \leq 0.10\text{mm}$	NC	NC	NC	
		$0.10 < D \leq 0.20\text{mm}$	3	3	NC	
		$0.20 < D \leq 0.30\text{mm}$	1	2	NC	
		$D > 0.30\text{ mm}$	0	0	NC	
NC: No count						
D: Mean Diameter of Defect						

12.1.2 Line Shape and Scratches

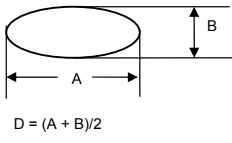
Defect Category	Defect Description	Criterion			Drawing Specification		
Line shape and scratches	Line shape and scratches	Zone /Dimension	Acceptable No.				
		X	Y	A	B		C
		-	<0.01mm	NC	NC		NC
		< 2 mm	< 0.02mm	1	1		NC
		<1 mm	< 0.0 2mm	1	2		NC

12.1.3 Pin Hole

Defect Category	Defect Description	Criterion	Drawing Specification
Pin Hole	Pin hole / void at light up segment	$D \leq 0.20\text{mm}$ within 1 part/segment	<p>D = (A + B)/2</p>



12.1.4 Polarizer Bubble/Foreign Material

Defect Category	Defect Description	Criterion			Drawing Specification	
	Polarizer bubble / Foreign material	Zone / Dimension	Acceptable No.			 <p>D = (A + B)/2</p>
		$D \leq 0.15\text{mm}$	NC	NC	NC	
		$0.15 < D \leq 0.30\text{mm}$	3	5	NC	
		$0.30 < D \leq 0.50\text{mm}$	2	3	NC	
		$0.50 < D \leq 1.0\text{mm}$	0	1	NC	
		NC: No count D: Mean Diameter of Defect Accept - if air bubble at the seal area does not propagate into effective viewing area				

Note: Total defects shall not exceed five



### 13. 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.

- b) Keep the temperature within the range of use and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel off or bubble.
- c) 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.
- d) 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.
- e) Glass can be easily chipped or cracked from rough handling, especially at corners and edges.
- f) 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 bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.

- a) 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 contrast can be adjusted by varying the LCD driving voltage  $V_0$
- 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”.

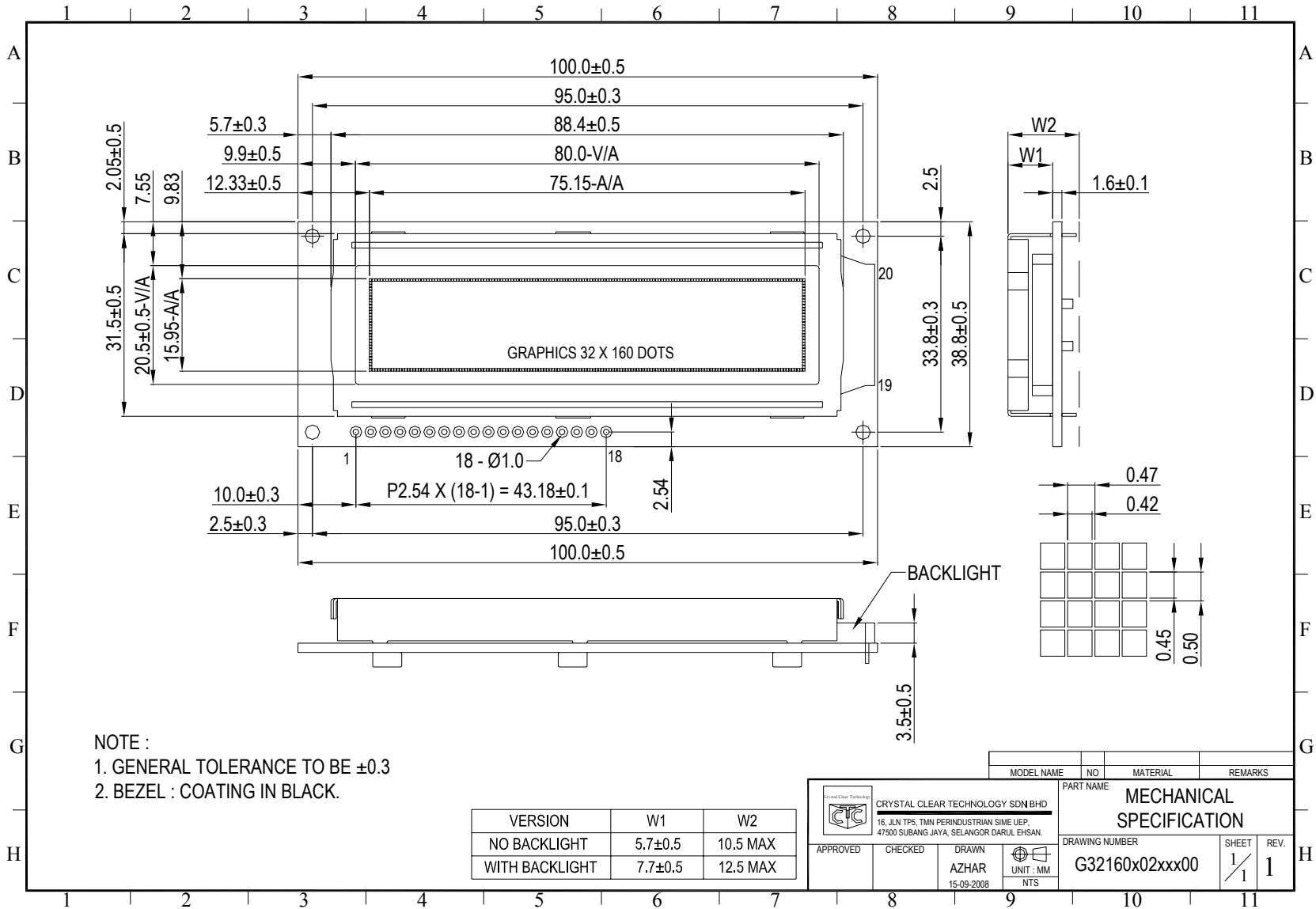
#### 2.5 Storage

If any fluid leaks out of the damaged 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 be responsible for any subsequent or consequential events.







**Crystal Clear Technology**  
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