

# Crystal Clear Technology

## Product Specification

### **G2064x02 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	04/12/08			Initial Release	Syam	Azhar
2.0	14/01/11	5.1	4	Add backlight option – white led	Khairiah	Azhar
3.0	03/02/11	3.0	3	Add Viewing Angle Option Update Mechanical Drawing	Khairiah	Azhar



**3.0 General specification**

Display format: Graphics 640 (w) x 200 (h) dots

Dot size: 0.30 (w) x 0.37 (h) mm

Dot pitch: 0.33 (w) x 0.34 (h) mm

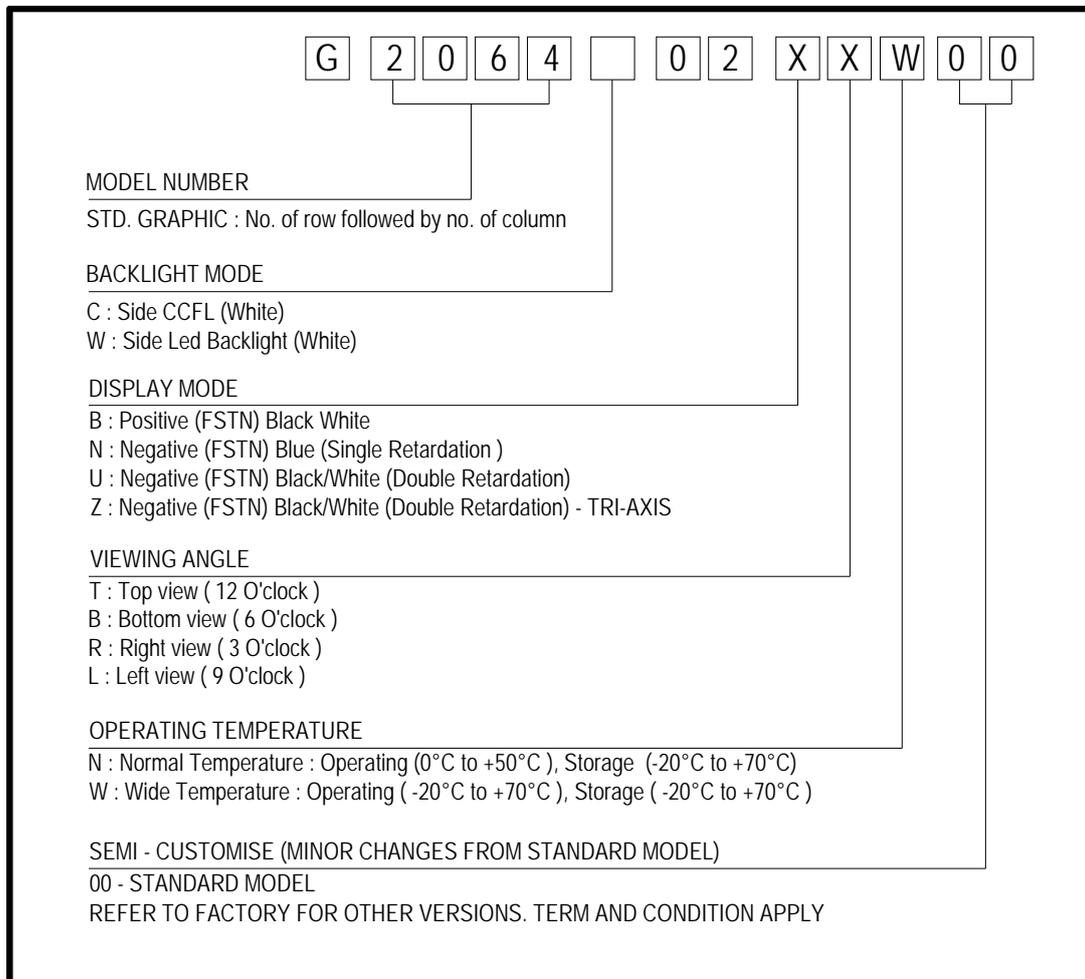
View area: 216.0 (w) x 83.2 (h) mm

Active area: 211.17 (w) x 79.17 (h) mm

General dimensions: 260.0(w) x 121.7 (h) x 15.0max (t) mm

Driver: NT7086 Neotech or equivalent

Driving method: 1/200 duty



4.0 Absolute maximum rating (at  $V_{SS} = 0V$ , ambient temperature =  $25^{\circ}C$ )

NO	ITEM	SIMBOL	MIN	MAX	UNIT
1.	Power Supply voltage (Logic)	$V_{DD} - V_{SS}$	0	6.0	V
2.	Power Supply voltage (LCD Driver)	$V_{LCD}$	$V_{DD} - 30$	$V_{DD}$	V
3.	Operating Temperature	$T_{op}$	Refer page 3		$^{\circ}C$
4.	Storage Temperature	$T_{st}$	Refer page 3		$^{\circ}C$

## 5.0 Electrical characteristics

NO	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
1.	Power Supply voltage (Logic)	$V_{DD} - V_{SS}$	-	4.75	5.0	5.25	V
2.	Power Supply voltage ( $V_{LCD}$ )	$V_{DD} - V_0$	$25^{\circ}C$	21.0 $\pm$ 5%			V
3.	Input Voltage (except OSC1)	$V_{IH}$	-	0.8 $V_{DD}$	-	-	V
		$V_{IL}$	-	-	-	0.2 $V_{DD}$	V
4.	Current Supply	$I_{DD}$	$V_{DD} - V_{SS} = 5V$	-	6.5	8	mA

## 5.1 Backlight Options

NO	COLOR	FORWARD VOLTAGE (V)			FORWARD CURRENT (mA)			MIN BRIGHTNESS (cd/m <sup>2</sup> ) *
		Min	Typ.	Max	Min	Typ.	Max	
1.	White (CCFL)	-	780V (AC)	-	-	5.0	-	100
2.	White (LED)		5.0V		250	300	350	700

\*Note : 1. Brightness measured at backlight surface.

2. On LCD surface, brightness is only about 10% to 15% of backlight brightness.

3. Lifetime of LED backlight: For YG = 50K hrs. For White, Blue = 20K hrs

4. Lifetime of CCFL backlight: For white = 10k 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

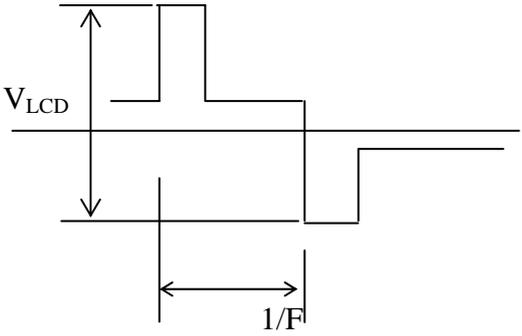
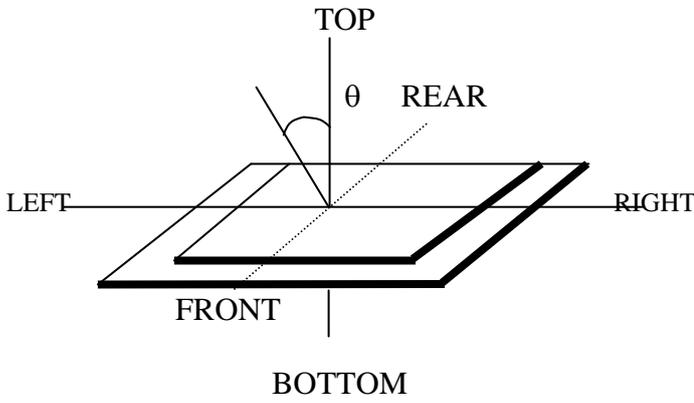
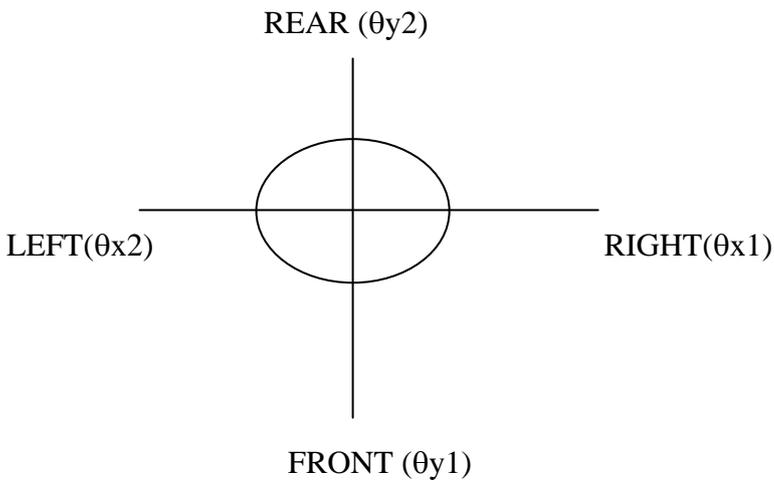
## 7.1 Electro-optical characteristics (at ambient temperature = 25°C)

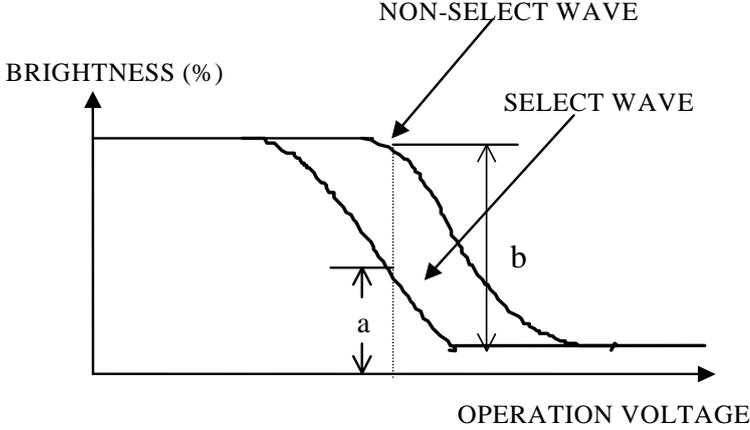
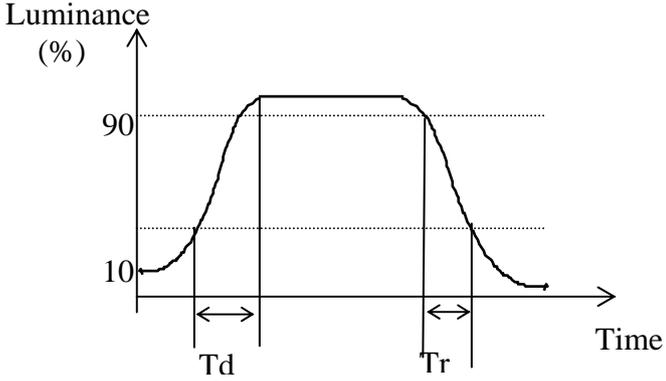
NO	ITEM	SYMBOL	CONDITION	LCD TYPE					REF.
				STN -VE BLUE/ PURPLE	FSTN +VE B/W	FSTN -VE BLUE	FSTN -VE TRUE B/W	FSTN -VE TRI AXIS	
1	Operating Voltage (Volt)	$V_{LCD}$	$\theta = 0$ $Cr = \max$	21.0 ± 5%					7.1.1
2	Viewing Angle (Deg)	$\theta x 1$	$CR \geq 2$ $V_{LCD} = 21.0V$	+35	+20	+35	+30	+40	7.1.2
		$\theta x 2$		-35	-20	-35	-35	-40	
		$\theta y 1$		-30	-25	-30	-30	-50	
		$\theta y 2$		+30	+25	+30	+30	+30	
3	Contrast Ratio	CR	$\theta = 0^0$ $V_{LCD} = 21.0V$	5.5	2.5	5.5	15	15	7.1.3
4	Response Time (msec)	Rise Time (Tr)	$\theta = 0^0$	400					
		Decay Time (Td)	$\theta = 0^0$	400					

## 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>

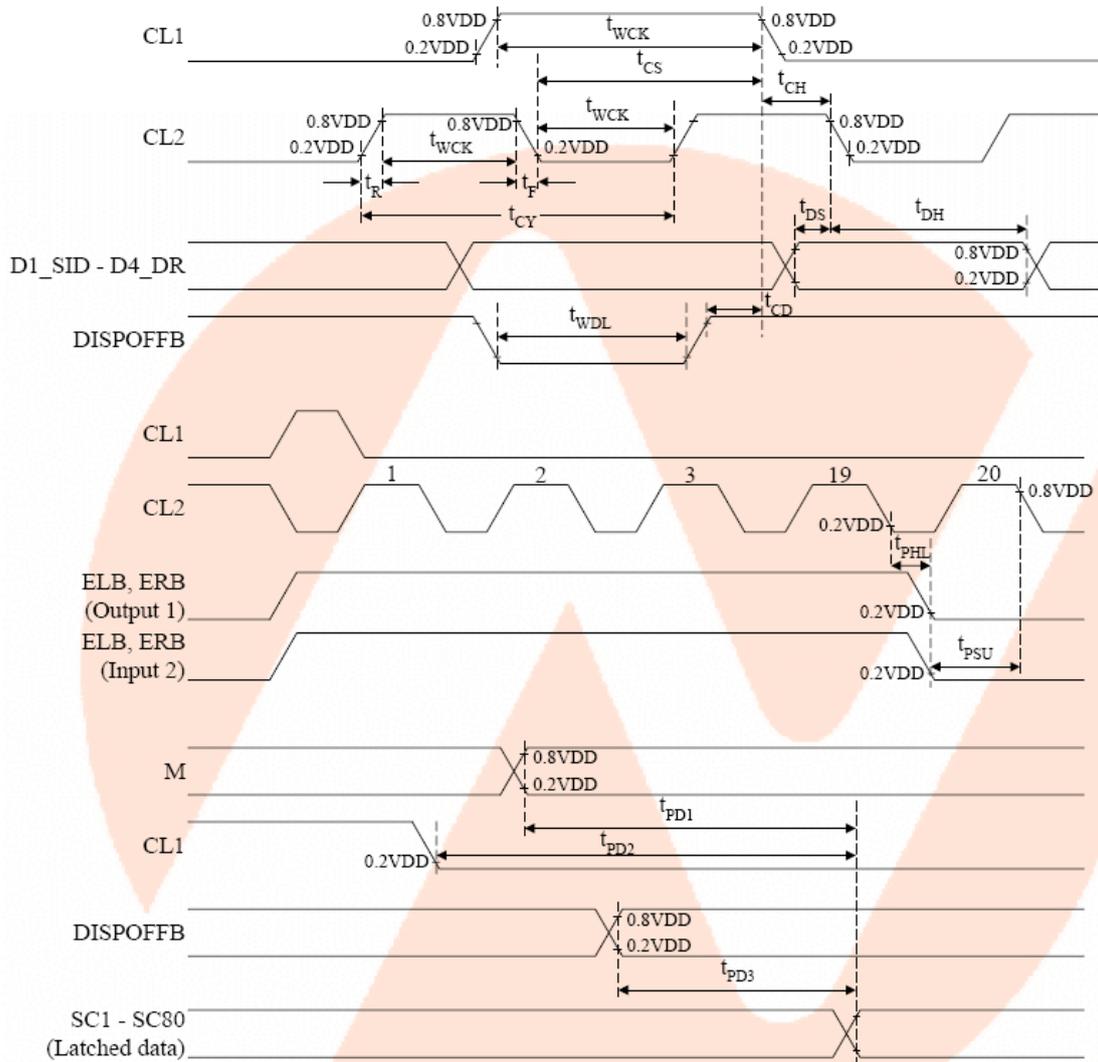
**8.0 Interface**

<b>8.1</b>	<b>Controller</b>	-	
<b>8.2</b>	<b>Display Driver</b>	NT7086 (Neotech)	
<b>8.3</b>	<b>Duty Cycle</b>	1/200	
<b>8.4</b>	<b>Pin-out Assignments</b>		
	<b>Pin No</b>	<b>Symbol</b>	<b>Description</b>
	1	V <sub>DD</sub>	Supply terminal of module
	2	FGND	Frame ground
	3	CL2	X-driver shift clock.(Data shift)
	4	INH	Display off signal-active low
	5	FLM	Frame signal
	6	CL1	Latch pulse for column driver. Shift clock for row Driver. ( data shift)
	7	VSS	Signal Ground = 0 V
	8	M	LCD drive output AC signal (internal )
	9 to 12	D0 to D3	Display data
	13	VLC	Negative supply voltage for LCD : -24V
	14	V <sub>O</sub>	LCD Contrast Adjust terminal
	15	VSS	Signal Ground = 0V



9.0 Functional Descriptions

9.1 Read/Write timing characteristics

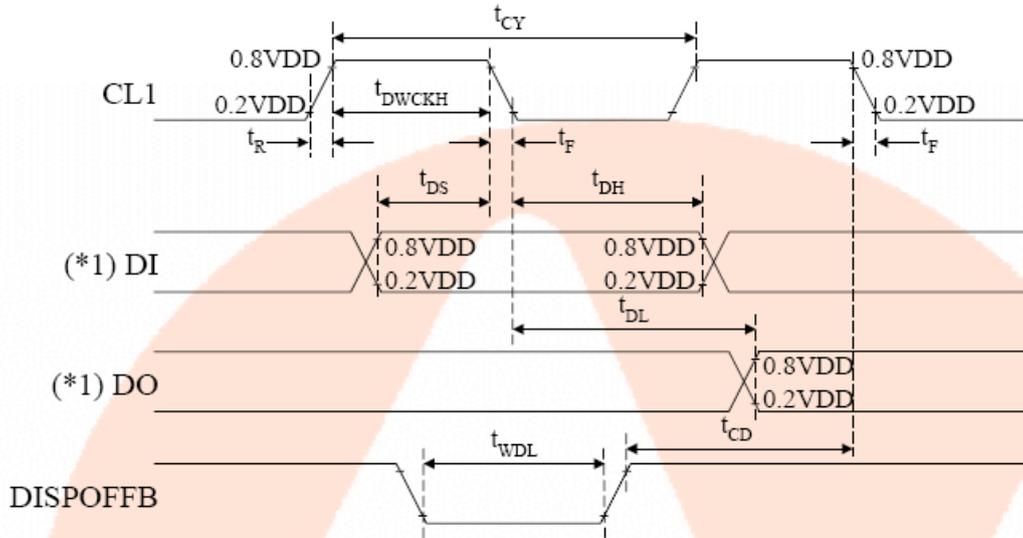




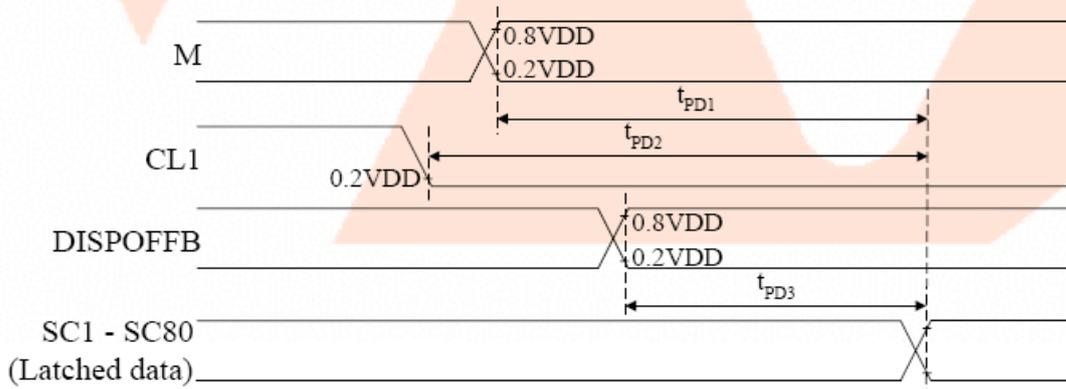
(V<sub>SS</sub> = 0V, Ta = - 30 ~ +85°C)

Characteristic	Symbol	Test condition	(1) VDD=5V±10%			(2) VDD=3V±10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t <sub>CY</sub>	Duty=50%	125	-	-	250	-	-	ns
Clock pulse width	t <sub>WCK</sub>	-	45	-	-	95	-	-	
Clock rise/ fall time	t <sub>R</sub> / t <sub>F</sub>	-	-	-	-	-	-	30	
Data set-up time	t <sub>DS</sub>	-	30	-	-	65	-	-	
Data hold time	t <sub>DH</sub>	-	30	-	-	65	-	-	
Clock set-up time	t <sub>CS</sub>	-	80	-	-	120	-	-	
Clock hold time	t <sub>CH</sub>	-	80	-	-	120	-	-	
Propagation delay time	t <sub>PHL</sub>	ELB output	-	-	60	-	-	125	
		ERB output	-	-	60	-	-	125	
ELB,ERB set-up time	t <sub>PSU</sub>	ELB input	30	-	-	65	-	-	
		ERB input	30	-	-	65	-	-	
DISPOFFB low pulse width	t <sub>WDL</sub>	-	1.2	-	-	1.2	-	-	μs
DISPOFFB clear time	t <sub>CD</sub>	-	100	-	-	100	-	-	ns
M – OUT propagation delay time	t <sub>PD1</sub>	C <sub>L</sub> =15pF	-	-	1.0	-	-	1.2	μs
CL1 – OUT propagation delay time	t <sub>PD2</sub>		-	-	1.0	-	-	1.2	
DISPOFFB – OUT propagation delay time	t <sub>PD3</sub>		-	-	1.0	-	-	-	

Segment Driver Application Timing and AC Characteristics)



(\*1) When in single-type interface mode  
DI=>DDL(SHL=L), D4\_DR(SHL=H)  
DO=>D4\_DR(SHL=L), D2\_DL(SHL=H)  
When in dual-type interface mode  
DI=>D2\_DL and D3\_DM(SHL=L), D4\_DR and D3\_DM(SHL=H)  
DO=>D4\_DR(SHL=L), D2\_DL(SHL=H)



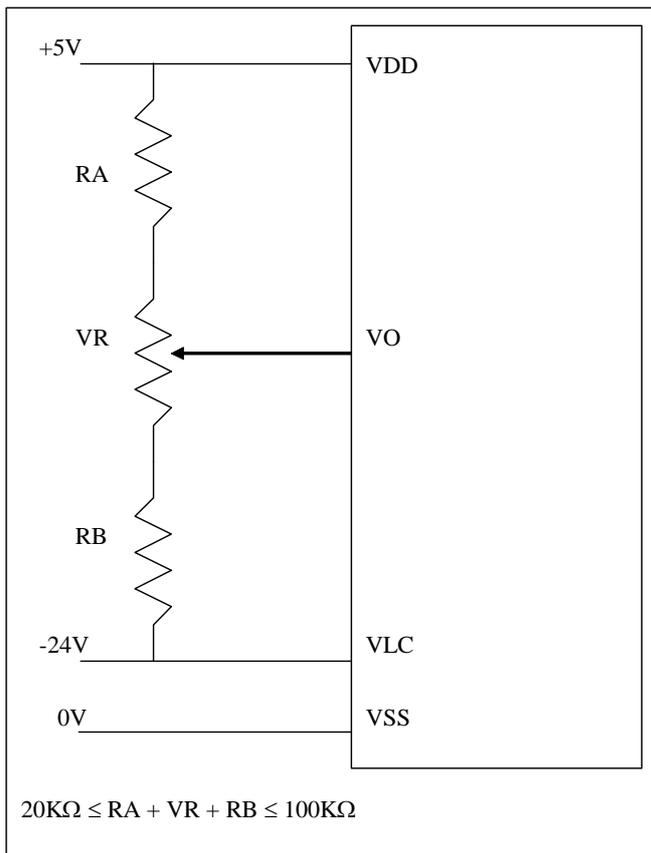


(V<sub>SS</sub> = 0V, Ta = - 30 ~ +85°C)

Characteristic	Symbol	Test condition	(1) VDD=5V±10%			(2) VDD=3V±10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t <sub>CY</sub>	Duty=50%	250	-	-	500	-	-	ns
Clock pulse width	t <sub>WCK</sub>	-	45	-	-	95	-	-	
Clock rise/ fall time	t <sub>R</sub> / t <sub>F</sub>	-	-	-	50	-	-	50	
Data set-up time	t <sub>DS</sub>	-	30	-	-	65	-	-	
Data hold time	T <sub>DH</sub>	-	30	-	-	65	-	-	
DISPOFFB low pulse width	t <sub>WDL</sub>	-	1.2	-	-	1.2	-	-	μs
DISPOFFB clear time	t <sub>CD</sub>	-	100	-	-	100	-	-	ns
Output delay time	t <sub>DL</sub>	-	-	-	200	-	-	250	
M – OUT propagation delay time	t <sub>PD1</sub>	C <sub>L</sub> =15pF	-	-	1.0	-	-	1.2	μs
CL1 – OUT propagation delay time	t <sub>PD2</sub>		-	-	1.0	-	-	1.2	
DISPOFFB – OUT propagation delay time	t <sub>PD3</sub>		-	-	1.0	-	-	1.2	

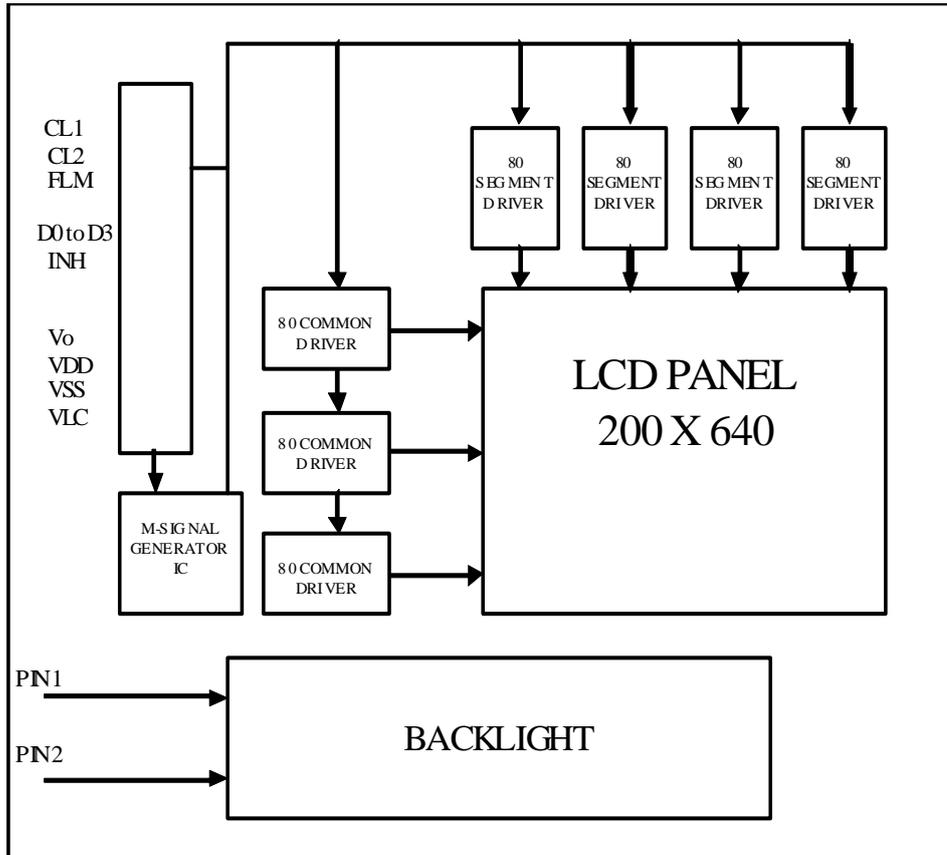
Common Driver Application Timing and AC Characteristics)

10. Power Supply





11. Block Diagram



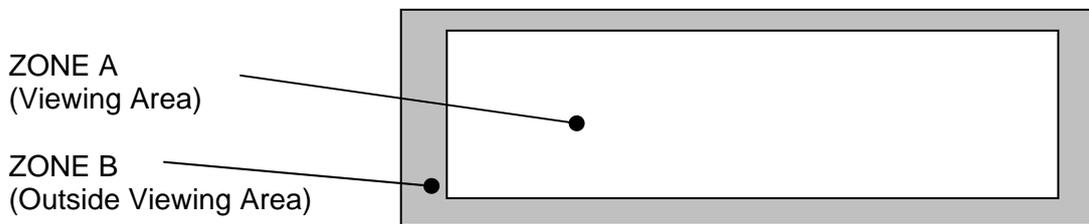


12.0 Quality Assurance

12.1 Sampling Plan

INSPECTION ITEM	Sampling Plan
VISUAL	AQL 0.4%
ELECTRICAL	AQL 0.4%
PACKAGING CONDITION	EVERY CARTON

12.2 Zone Definitions



12.3 Visual Inspection

- 13.3.1 Visual Inspection should be conducted under a fluorescent lamp at distance of 2 meter between Module and light source.
- 13.3.2 The Inspection distance between inspector eyes and the Module should be 30cm away.
- 13.3.3 Appearance is inspected at the best contrast voltage (best contrast is adjusted to consider clearness and cross talk on screen)
- 13.3.4 Viewing angle should be 45° with no lighting glare.

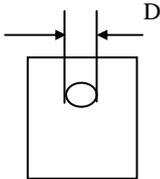
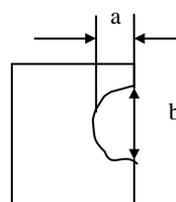


**12.4 Defects Standards When Display OFF**  
 (5 are the totally permissible numbers of defects in Zone A including item 1 to 5 of “Defects Standards When Display OFF and ON”)

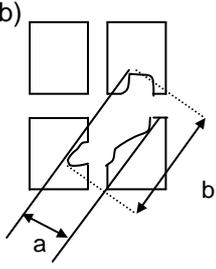
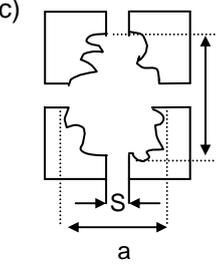
No	Item	Detail	Size (mm) (D = (long axis + short axis)/2)	Maximum Acceptable No.	
				Zone A	Zone B
1	Black / White Spot	Black / white spot cause by dust, bubble or defect in the cell or polarizer	D ≤ 0.15 0.15 < D ≤ 0.25 0.25 < D ≤ 0.35 D > 0.35	NC 3 2 0	NC
2	Polarizer bubble	Bubble between the glass and polarizer	D ≤ 0.20 0.20 < D ≤ 0.50 0.50 < D ≤ 1.0 D > 1.0	NC 3 1 0	NC
			W ≤ 0.15      L ≤ 5.0 W ≤ 0.15      L ≤ 10.0	2 1	
			Other than above	0	
3	Polarizer Dented	Dent on the polarizer	D ≤ 0.50 0.50 < D ≤ 1.00 D > 1.00	2 1 0	NC
4	Polarizer Scratches	Scratches on the polarizer	Visible with the naked eye	Same as No 2 (polarizer bubble)	NC
			Not visible with the naked eye	NC	NC
5	Chromaticity and uniformity	Streaks and uneven color		Limit sample	
6	Dirt	Dirt on polarizer, bezel and PCB		Product pass if the dirt can be wiped off easily	



12.5 Defects Standards When Display ON

No	Item	Detail	Size (mm) D = (long axis + short axis)/2	Maximum Acceptable No.	
				Zone A	Zone B
1	Black / White Spot (Round Shape - solid figure)	The solid figure is that the defect has clear-cut outline at the best contrast driving condition. Size does not change when the contrast changes	D ≤ 0.15 0.15 < D ≤ 0.25 0.25 < D ≤ 0.35 D > 0.35	NC 3 2 0	NC
2	Black / White Spot (Round Shape - faded figure)	The faded means that the defects has unclear outline at the best contrast driving condition. Size to change when the contrast changes	D ≤ 0.60 0.60 < D ≤ 0.70 0.70 < D ≤ 0.80 D > 0.80	NC 3 1 0	NC
3	Black / White Spot (Linear - fibrous)	Length (L) is the whole length and width (W) is the maximum width of foreign material	L – Disregard    W ≤ 0.03 L ≤ 2.00        W ≤ 0.05 L ≤ 1.00        W ≤ 0.10	NC 3 3	NC
4	Pin hole	Parts of display segment missing because of pin hole or an open 	D ≤ 0.10 0.10 < D ≤ 0.20 0.20 < D ≤ 0.25 0.25 < D ≤ 0.30 D > 0.30	NC 3 2 1 0	NC
5	Deformed display pixel	a) 	a ≤ 0.10        b ≤ 0.10 a ≤ 0.20        b ≤ 0.25 a ≤ 0.25        b ≤ 0.30 a > 0.25        b > 0.30	NC 3 2 0	NC



		<p>b)</p> 	<p> <math>a \leq 0.03</math>  <math>a &lt; 0.05</math>      <math>b &lt; 0.5</math>  <math>a \leq 0.10</math>     <math>b \leq 0.3</math>  <math>a \leq 0.20</math>     <math>b \leq 0.3</math> </p> <p>Other than above</p>	<p>NC 3 2 1 0</p>	<p>NC</p>
		<p>c)</p>  <p>S = segment air gap S = 0.03</p>	<p> <math>a \leq 0.036</math>      L - Disregard  <math>a \leq 0.042</math>      L ≤ 10.0  <math>a \leq 0.042</math>      L &gt; 10.0  <math>a &gt; 0.042</math>      L - Disregard </p>	<p>NC 2 0 0</p>	<p>NC</p>



## 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 benzine.
- 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

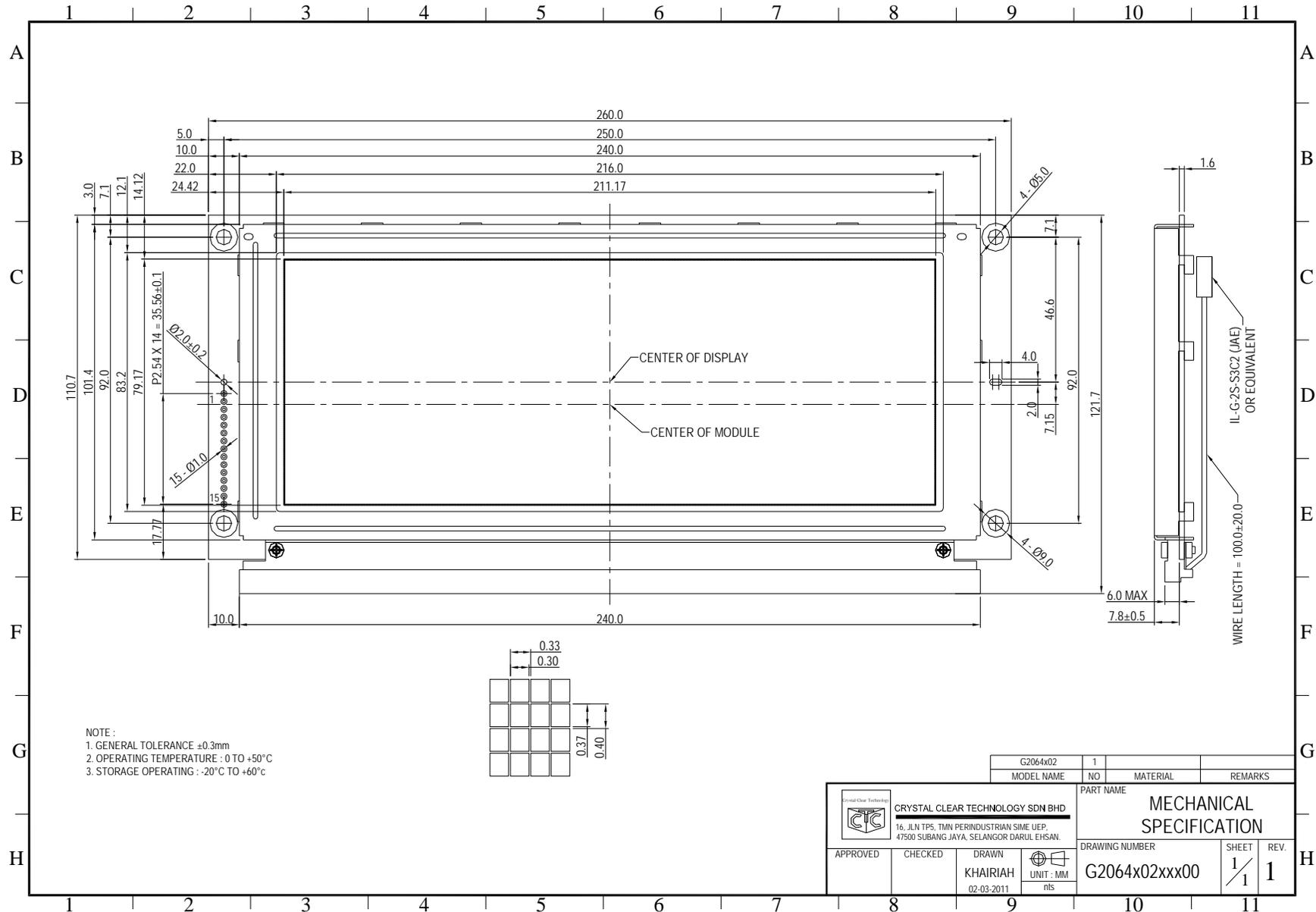
- a) The contrast can be adjusted by varying the LCD driving voltage  $V_0$
- b) Driving voltage should be kept within specified range, excess voltage shortens display life.
- c) Response time increases with decrease in temperature.
- d) Display may turn black or dark blue at temperature above its operational 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.



G2064x02		1		
MODEL NAME		NO	MATERIAL	REMARKS
PART NAME				
<b>MECHANICAL SPECIFICATION</b>				
DRAWING NUMBER		SHEET		REV.
G2064x02xxx00		1/1		1



**Crystal Clear Technology**  
**16 Jalan TP5—Taman Perindustrian Sime UEP**  
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