Crystal Clear Technology

Product Specification

C216x08 series

Crystal Clear Technology sdn. bhd.
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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: Characters 2 x 16 COG

Character size: 5 x 8

Character size: 2.95mm x 5.55mm

View area: 61.0mm x 15.7mm

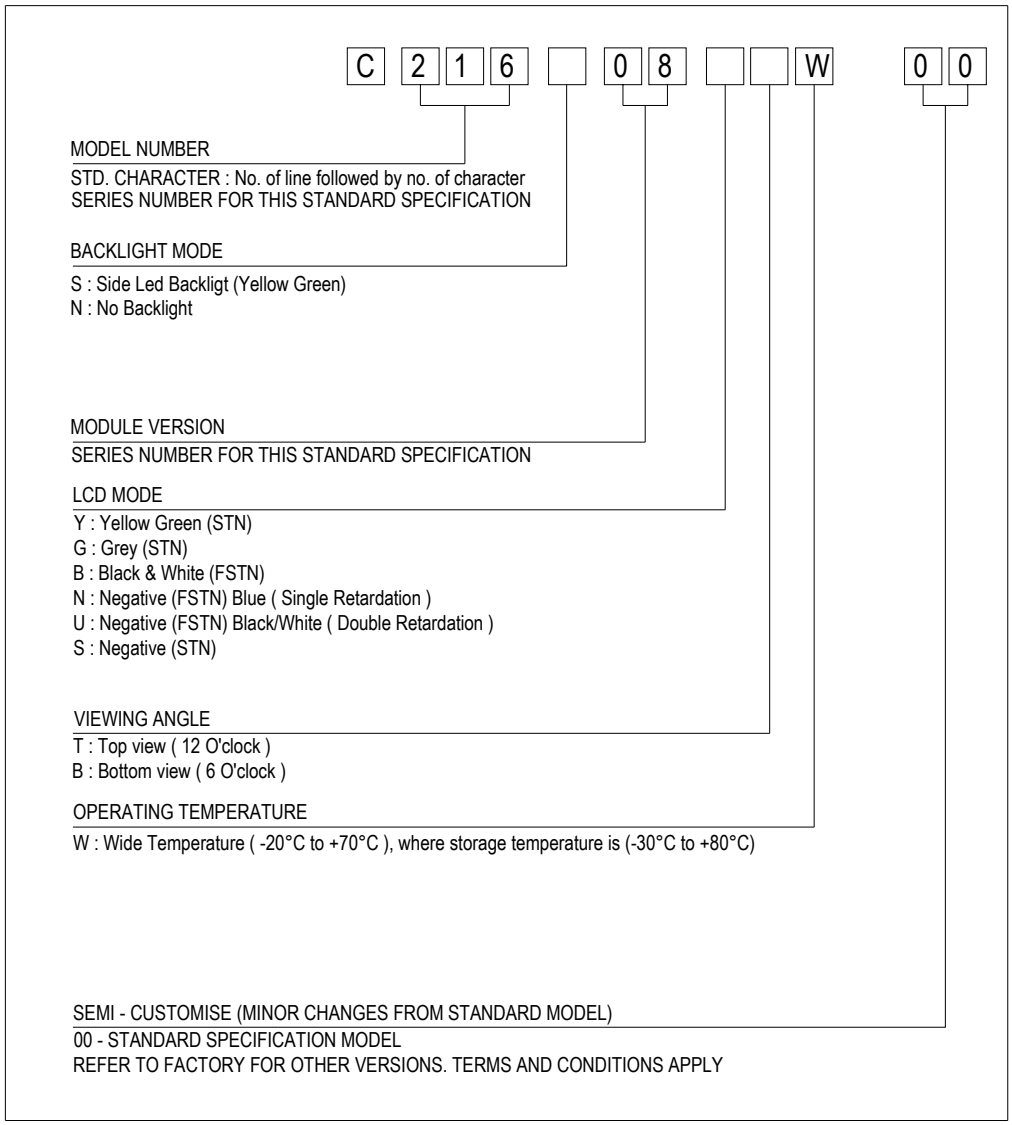
Active area: 56.20mm x 11.6mm

General dimensions: 68.6mm x 27.7mm

Controller/Driver: NT7603H or equivalent

Microprocessor interface: Parallel (Connection: FPC)

Driving Method : 1/16 duty, 1/5 bias



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}	-0.3	7	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}	-	4.5	5.0	5.5	V
2.	Power Supply voltage (V_{LCD})	V_{DD}-V_5	25°C	4.5±5%			V
3.	Current Supply	I_{DD}	V_{DD} = 5V	-	1.0	1.5	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	-	4.1	-	-	20	40	1

*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.

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.

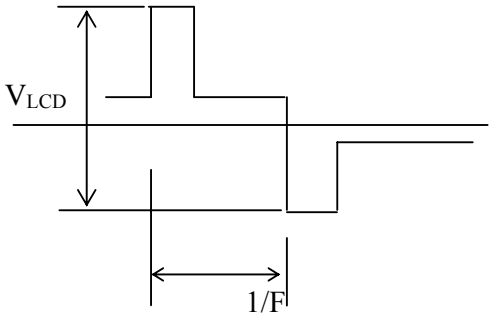
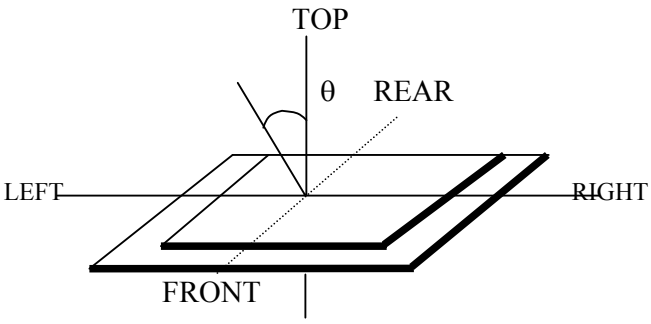
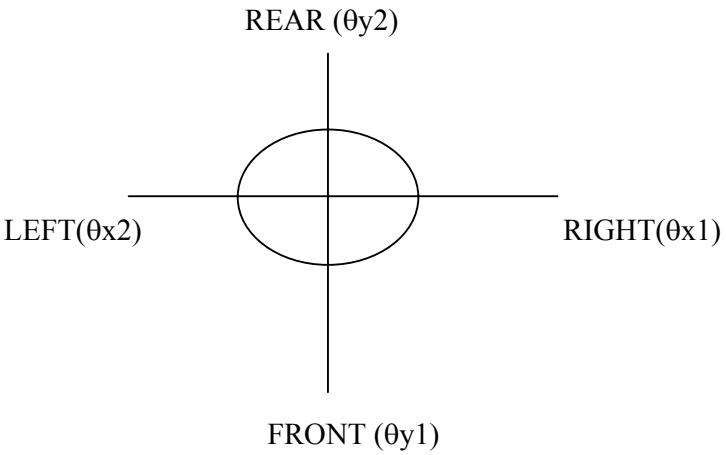
7.0 LCD specification

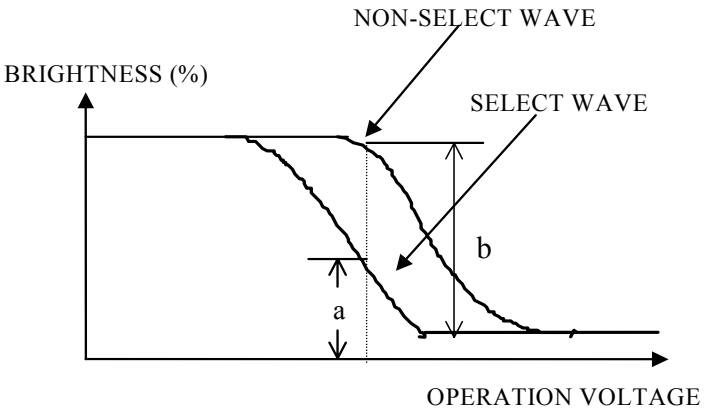
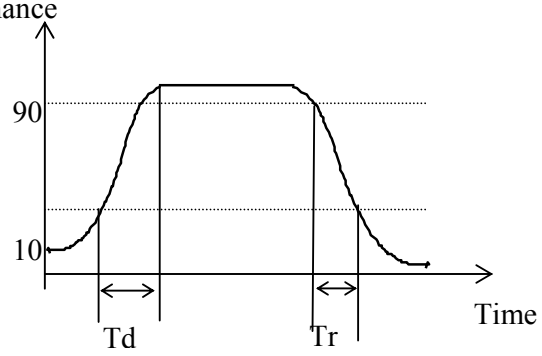
7.1 Electro-optical characteristics (at ambient temperature = 25°C)

NO	ITEM	SYMBOL	CONDITION	LCD TYPE						REF.
				STN YG	STN GREY	STN -VE BLUE	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	+25	+20	+35	+25	+35	+35	7.1.2
		θ x 2		-25	-20	-35	-25	-35	-40	
		θ y 1		-30	-25	-35	-30	-35	-35	
		θ y 2		+30	+25	+35	+30	+35	+35	
3	Contrast Ratio	CR	θ = 0^0 V_{LCD} =4.5V	3.0	2.3	6.0	3.0	6.0	20	7.1.3
4	Response Time (msec)	Rise Time (Tr)	θ = 0^0	200						7.1.4
		Decay Time (Td)	θ = 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	***Definition of Operating Voltage (V_{LCD})***	 V_{LCD} : Operating Voltage F : Frame Frequency
7.1.2	***Definition of Viewing Angle***	 

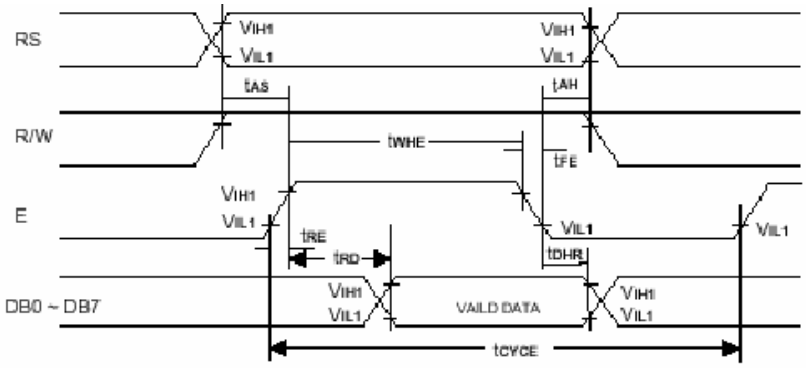
7.1.3	***Definition of Contrast Ratio***	 Contrast Ratio = Brightness of non-selected state (b) / Brightness of selected state (a) ***Conditions*** (a) Operating Voltage: V_{LCD} (b) Temperature: 25°C (c) Viewing Angle, $\theta = 0^o$
7.1.4	*Response Time*	Luminance (%)  Tr: Measured between 10% and 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

Pin No.	Symbol	Function
1	GND	Ground
2	V5	Driving supply voltage
3	VDD	Logic power supply
4	RS	Register select input
5	R/W	Read and write input
6	E	Read/Write start signal
7	DB0	Data input
8	DB1	Data input
9	DB2	Data input
10	DB3	Data input
11	DB4	Data input
12	DB5	Data input
13	DB6	Data input
14	DB7	Data input

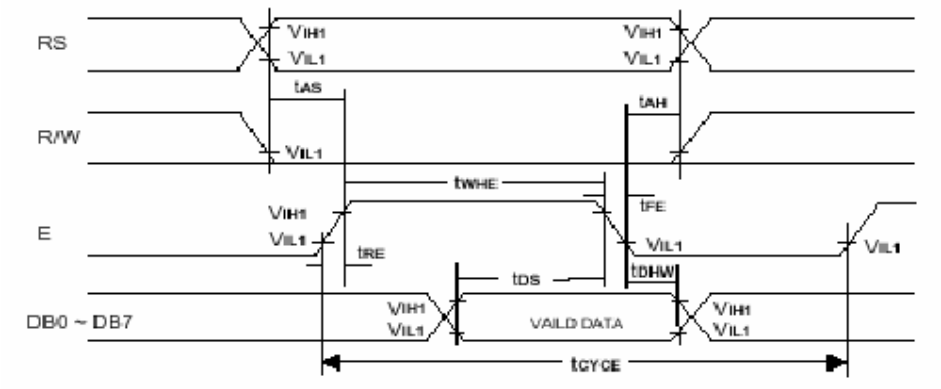
9.0 Timing characteristics / Timing diagrams

9.1 Read Timing Signal



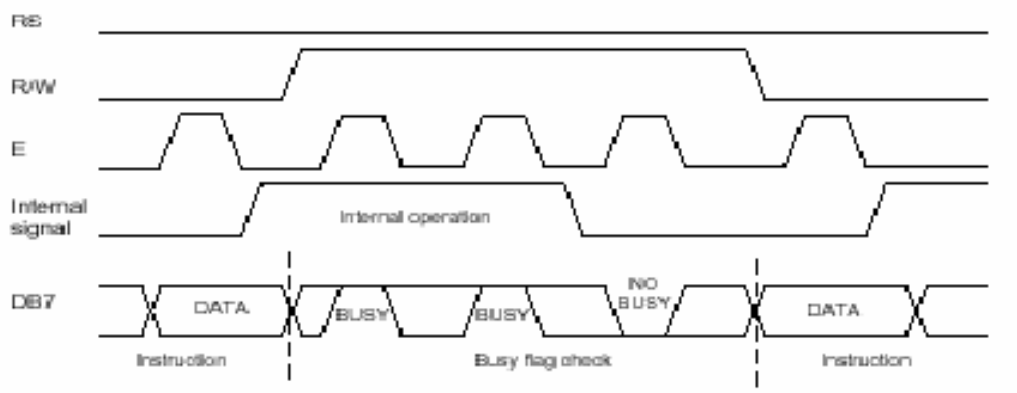
Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
t_{CYCE}	Enable Cycle Time	500	-	-	ns	Figure 1
t_{WHE}	Enable "H" Level Pulse Width	300	-	-	ns	Figure 1
t_{RE}, t_{FE}	Enable Rise/Fall Time	-	-	25	ns	Figure 1
t_{AS}	RS, R/W Setup Time	60[1] 100[2]	-	-	ns	Figure 1
t_{AH}	RS, R/W Address Hold Time	10	-	-	ns	Figure 1
t_{RD}	Read Data Output Delay	-	-	190	ns	Figure 1
t_{DHR}	Read Data Hold Time	20	-	-	ns	Figure 1

9.2 Write Timing Signal

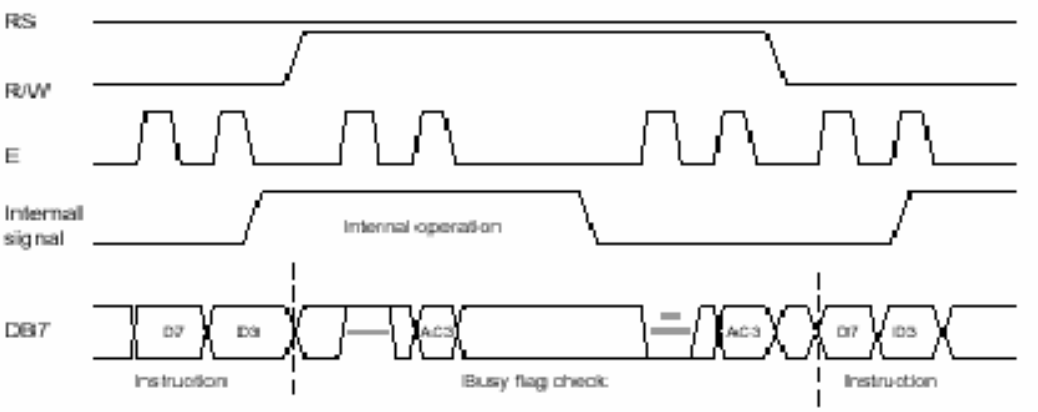


Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
t_{CYCE}	Enable Cycle Time	500	-	-	ns	Figure 2
t_{WHE}	Enable "H" Level Pulse Width	300	-	-	ns	Figure 2
t_{RE}, t_{FE}	Enable Rise/Fall Time	-	-	25	ns	Figure 2
t_{AS}	RS, R/W Setup Time	60[1]	-	-	ns	Figure 2
		100[2]				
t_{AH}	RS, R/W Address Hold Time	10	-	-	ns	Figure 2
t_{DS}	Data Output Delay	100	-	-	ns	Figure 2
t_{DHR}	Data Hold Time	10	-	-	ns	Figure 2

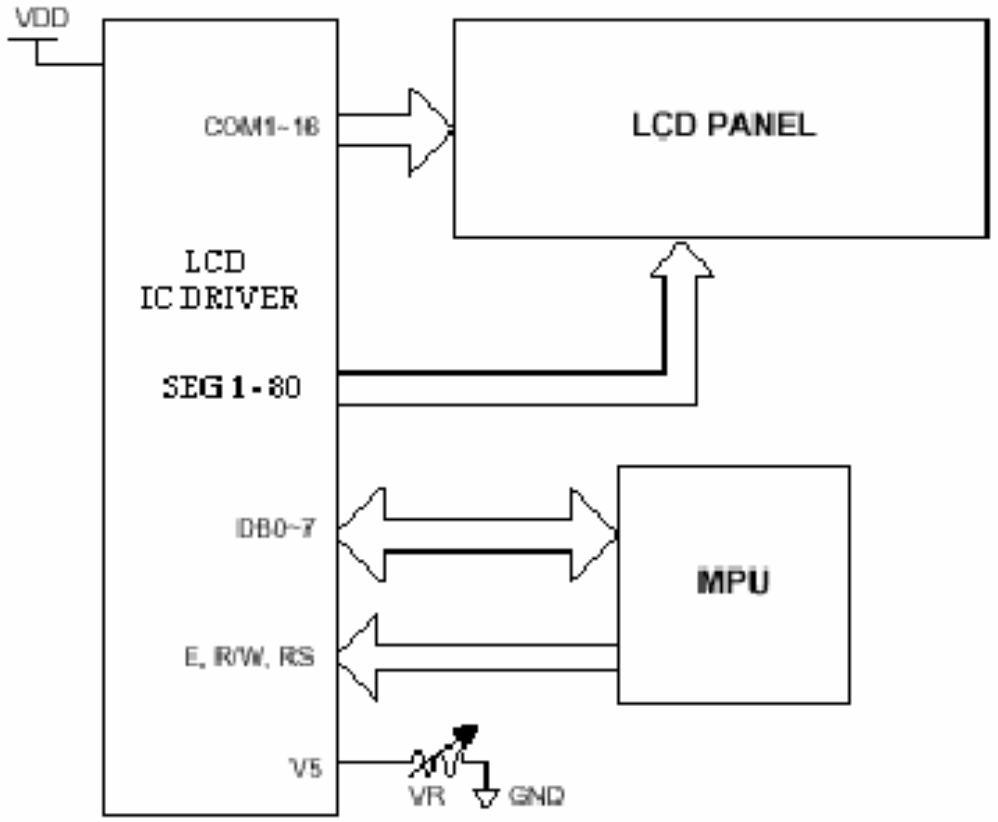
9.3 Interface with 8-bit MPU



9.4 Interface with 4-bit MPU



10. Application Block Diagram/Circuit



11. Instructions

Instruction	Code										Function	Execution time (max) (fosc = 250kHz)
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Display Clear	0	0	0	0	0	0	0	0	0	1	Clear entire display area, restore display from shift, and load address counter with DDRAM address 00h.	1.64ms
Display/ Cursor Home	0	0	0	0	0	0	0	0	1	*	Restore display from shift and load address counter with DDRAM address 00h.	1.64ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/ D	S	Specify direction of cursor movement and display shift mode. This operation takes place after each data transfer (read/write).	40us
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	Specify activation of display (D) cursor (C) and blinking of character at cursor position (B).	40us
Display/ Cursor Shift	0	0	0	0	0	1	S/ C	R/ L	*	*	Shift displays or move cursor.	40us
Function Set	0	0	0	0	1	D L	1	0	*	*	Set interface data length (DL), number of display line (N), and character font (F).	40us
RAM Address Set	0	0	0	1	ACG						Load the address counter with a CGRAM address. Subsequent data access is for CGRAM data.	40us
DDRAM Address Set	0	0	1	ADD							Load the address counter with a DDRAM address. Subsequent data access is for DDRAM data.	40us
Busy Flag/ Address Counter Read	0	1	B F	AC							Read Busy Flag(BF) and contents of Address Counter (AC)	40us
CGRAM/ DDRAM Data Write	1	0	Write data								Write data to CGRAM or DDRAM	40us
CGRAM/ DDRAM Data Read	1	1	Read data								Read data from CGRAM or DDRAM	40us

Note: Symbol "*" signifies an insignificant bit (disregard)

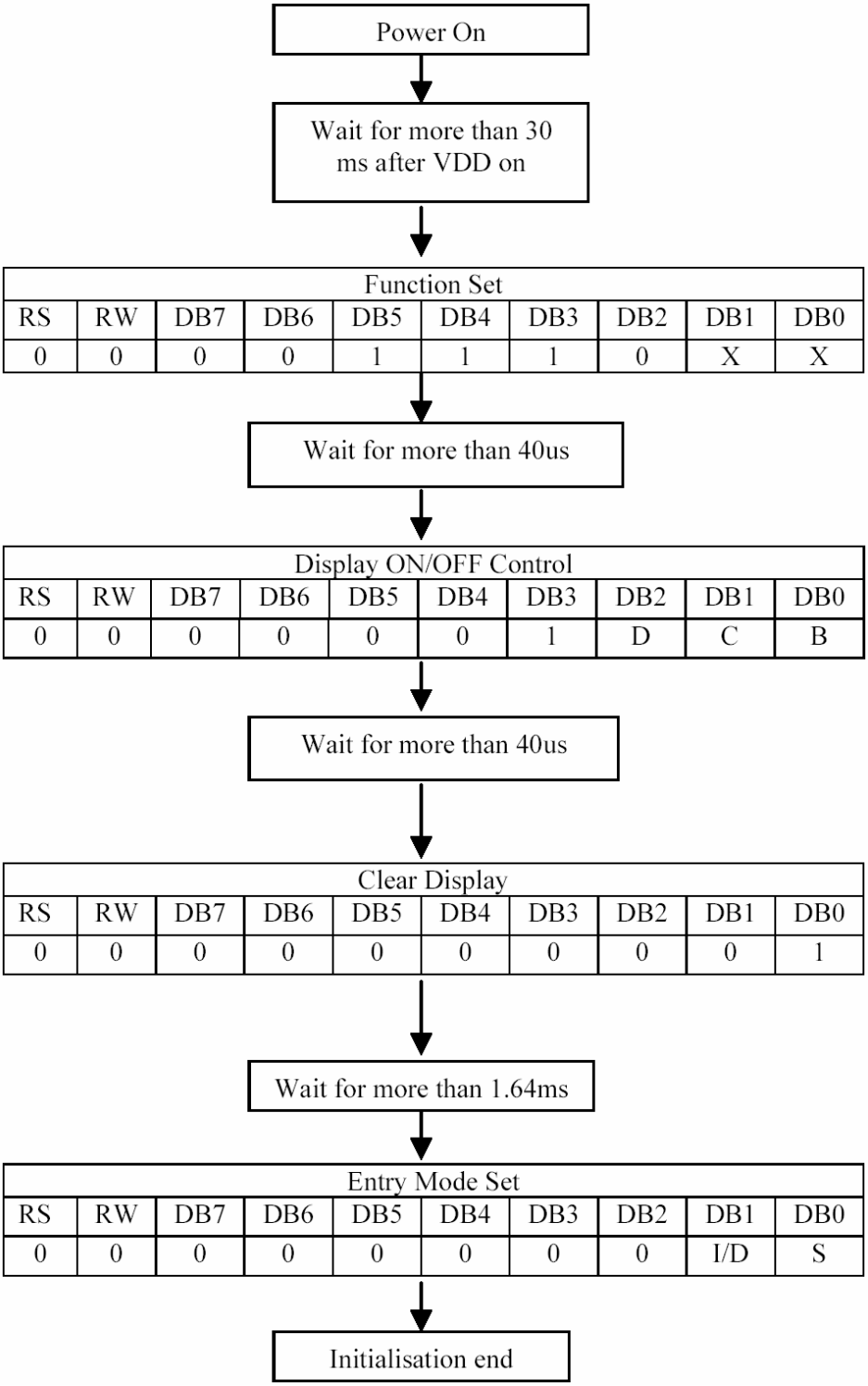
DDRAM : Display Data RAM
CGRAM : Character Generator RAM
ACG : Character Generator RAM Address
ADD : Display Data RAM Address
AC : Address Counter

I/D	= 1	:	Increment	I/D	= 0	:	Decrement
S	= 1	:	Display Shift On				
D	= 1	:	Display On				
C	= 1	:	Cursor Display On				
B	= 1	:	Cursor Blink On				
S/C	= 1	:	Shift Display	S/C	= 0	:	Move Cursor
R/L	= 1	:	Shift Right	R/L	= 0	:	Shift Left
DL	= 1	:	8-bit	DL	= 0	:	4-bit
BF	= 1	:	Internal Operation				
BF	= 0	:	Ready for Instruction				

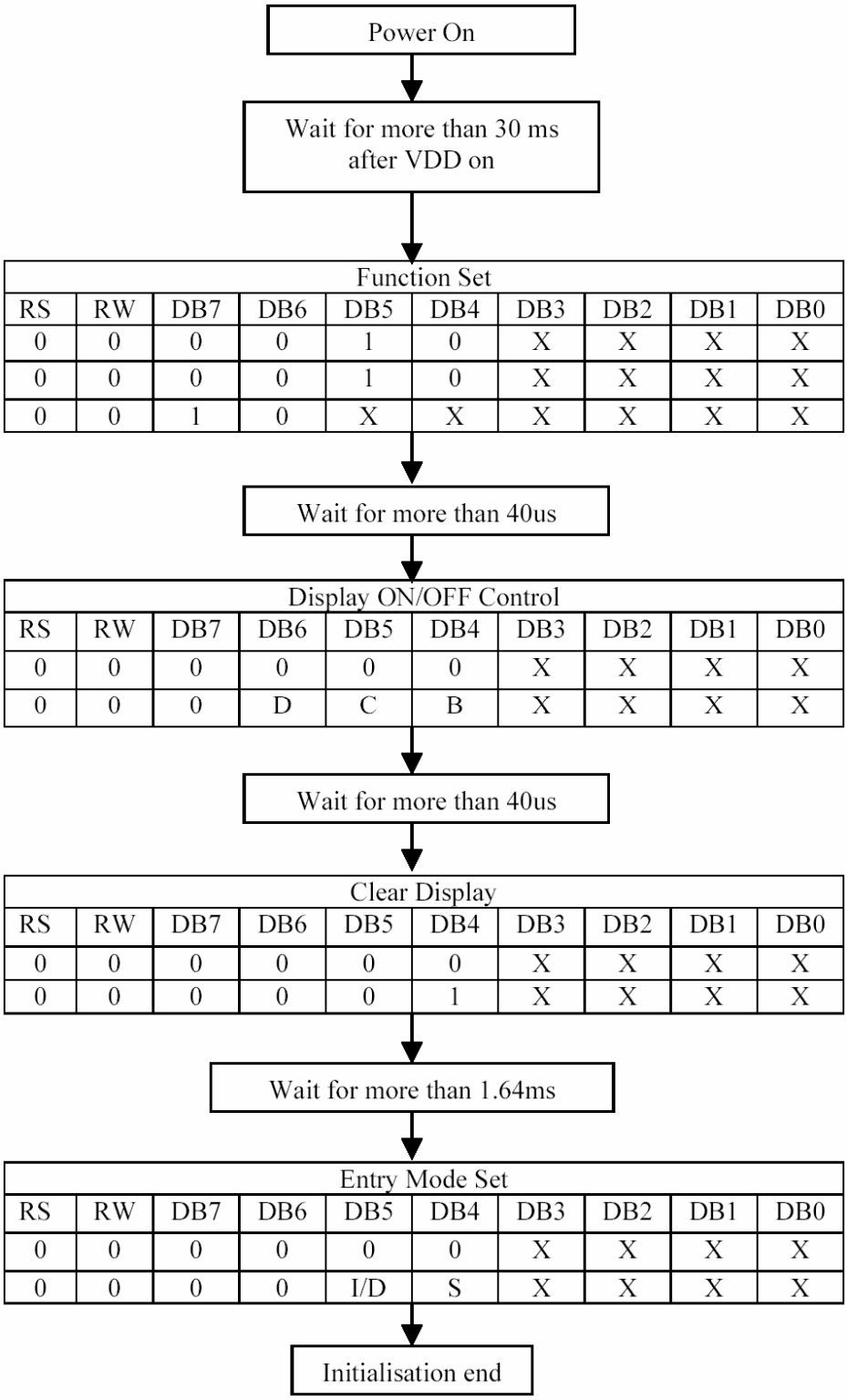
Character Generator ROM (NT7603)

12.0 LCD Module Initialization Flow

12.1 8-bit interface

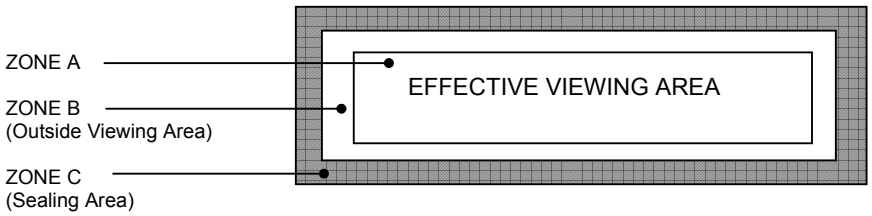


12.2 4-bit interface

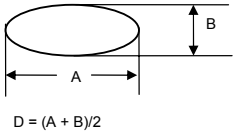


13.0 Quality Assurance

13.1 ZONE DEFINITION



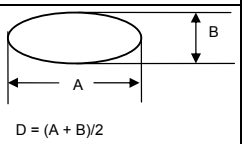
13.1.1 Black Spot, White Spot and Foreign Material

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				

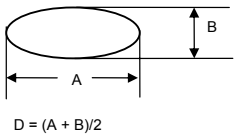
13.1.2 Line Shape and Scratches

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>Zone /
Dimension</td><td colspan="3">Acceptable No.</td></tr>
<tr><td></td><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> 
</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.

b) Keep the temperature within the range of use and storage. Excessive temperature and humidity could cause polarization degredation, 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

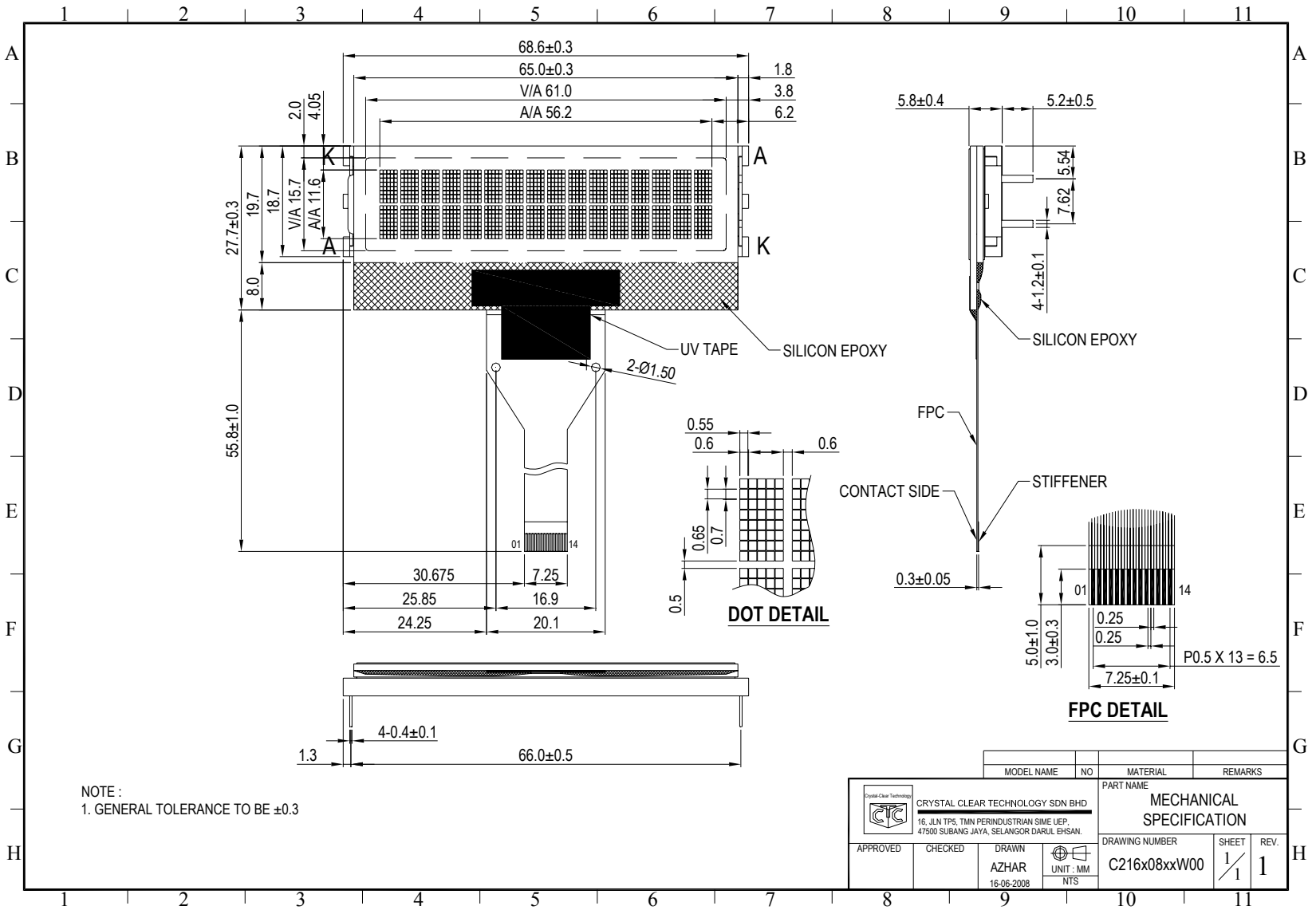
a) The contras can be adjusted by varying the LCD driving voltage V0
b) Driving voltage should be kept within specified range, excess voltage shortens display life.
c) Response time increases with decrease in temperature.
d) Display may turn black or dark blue at temperature above its operational range, 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.


68.6±0.3
65.0±0.3
V/A 61.0
A/A 56.2
1.8
3.8
6.2
2.0
4.05
K
A
A
K
27.7±0.3
19.7
18.7
V/A 15.7
A/A 11.6
8.0
55.8±1.0
UV TAPE
SILICON EPOXY
2-Ø1.50
01
14
30.675
25.85
24.25
7.25
16.9
20.1
4-0.4±0.1
1.3
66.0±0.5
0.55
0.6
0.6
0.65
0.7
0.5
DOT DETAIL
5.8±0.4
5.2±0.5
5.54
7.62
4-1.2±0.1
SILICON EPOXY
FPC
CONTACT SIDE
STIFFENER
0.3±0.05
01
14
0.25
0.25
P0.5 X 13 = 6.5
7.25±0.1
5.0±1.0
3.0±0.3
FPC DETAIL
NOTE :
1. GENERAL TOLERANCE TO BE ±0.3
MODEL NAME
NO
MATERIAL
REMARKS
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
AZHAR
16-06-2008
UNIT : MM
NTS
DRAWING NUMBER
C216x08xxW00
SHEET
1/1
REV.
1

Crystal Clear Technology

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