Crystal Clear Technology

Product Specification

C420x01 series

Crystal Clear Technology sdn. bhd.

16Jalan TP5—Taman Perindustrian Sime UEP
47600 Subang Jaya—Selangor DE
Malaysia. T: +603 80247099 F: +603 80247098

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: 4 lines x 20 characters
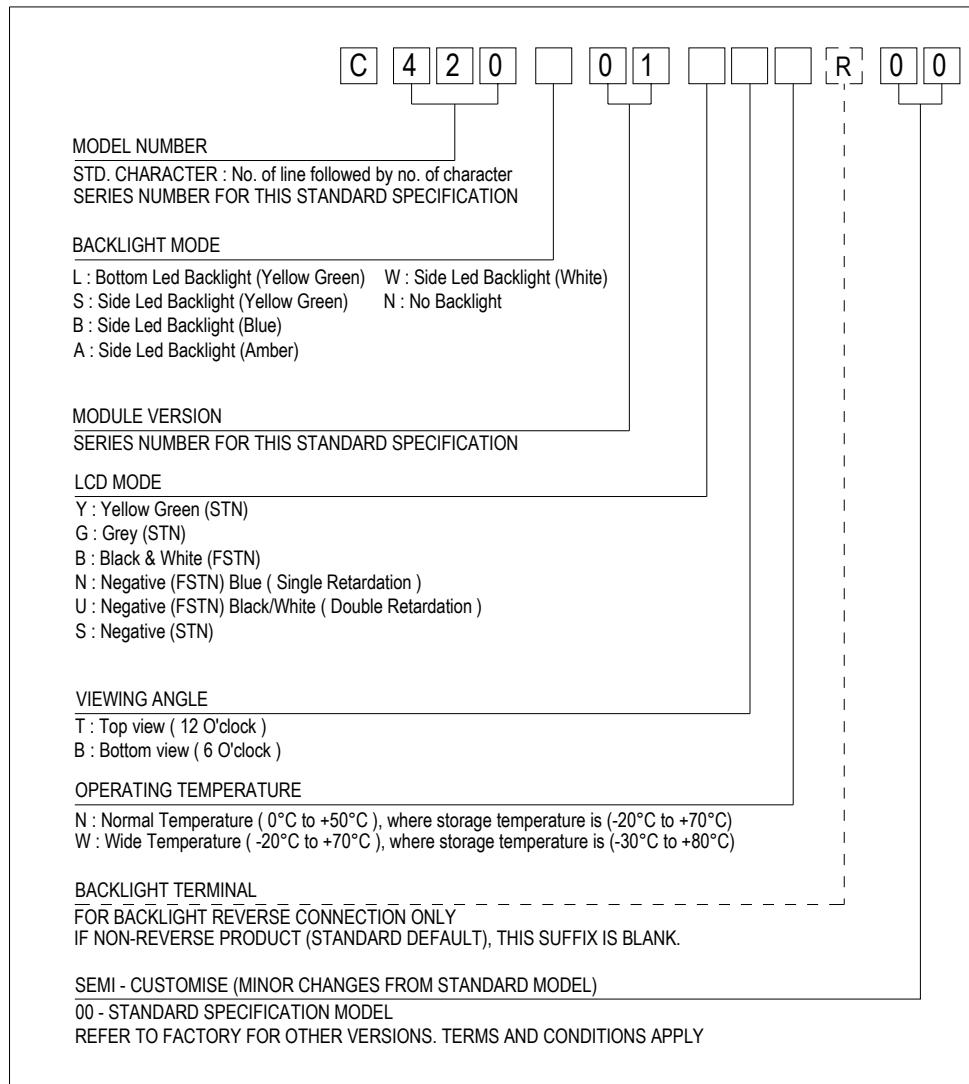
Character font format: 5 x 8

Character size: 2.95mm x 4.75mm

View area: 76.3mm x 25.0mm

Active area: 70.4mm x 20.8mm

General dimensions: 98.0mm x 60.0mm

Controller/Driver: ST7066U-0A-B and ST7063C-B or S6A0066U and S6A2067 or equivalent.

```
C 4 2 0 _ 0 1 _ _ _ R 0 0
```

MODEL NUMBER
STD. CHARACTER : No. of line followed by no. of character
SERIES NUMBER FOR THIS STANDARD SPECIFICATION

BACKLIGHT MODE
L : Bottom Led Backlight (Yellow Green)   W : Side Led Backlight (White)
S : Side Led Backlight (Yellow Green)   N : No Backlight
B : Side Led Backlight (Blue)
A : Side Led Backlight (Amber)

MODULE VERSION
SERIES NUMBER FOR THIS STANDARD SPECIFICATION

LCD MODE
Y : Yellow Green (STN)
G : Grey (STN)
B : Black & White (FSTN)
N : Negative (FSTN) Blue (Single Retardation)
U : Negative (FSTN) Black/White (Double Retardation)
S : Negative (STN)

VIEWING ANGLE
T : Top view (12 O'clock)
B : Bottom view (6 O'clock)

OPERATING TEMPERATURE
N : Normal Temperature (0°C to +50°C), where storage temperature is (-20°C to +70°C)
W : Wide Temperature (-20°C to +70°C), where storage temperature is (-30°C to +80°C)

BACKLIGHT TERMINAL
FOR BACKLIGHT REVERSE CONNECTION ONLY
IF NON-REVERSE PRODUCT (STANDARD DEFAULT), THIS SUFFIX IS BLANK.

SEMI - CUSTOMISE (MINOR CHANGES FROM STANDARD MODEL)
00 - STANDARD SPECIFICATION MODEL
REFER TO FACTORY FOR OTHER VERSIONS. TERMS AND CONDITIONS APPLY

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	1.3	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	-	5.0	-	-	95	130	100
2.	White	-	5.0	-	-	40	60	100
3.	Blue	-	5.0	-	-	40	60	6
4.	YG Side	-	5.0	-	-	26	40	6
5.	Amber Side	-	5.0	-	-	26	40	20

*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, Amber = 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.
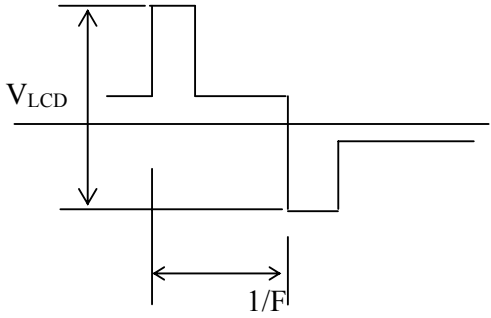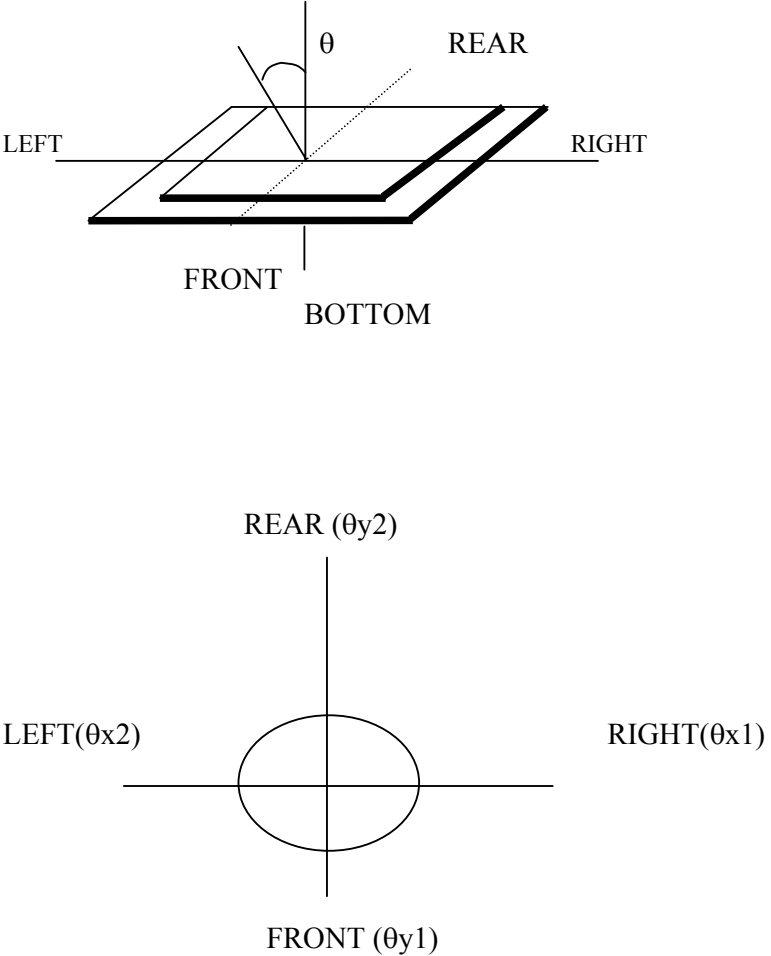
7.0   LCD specification

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

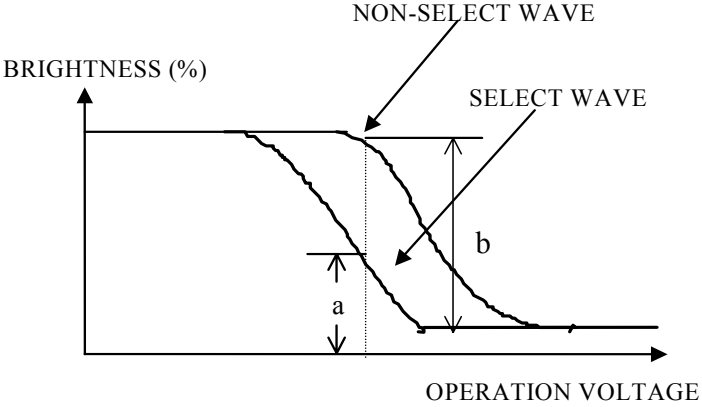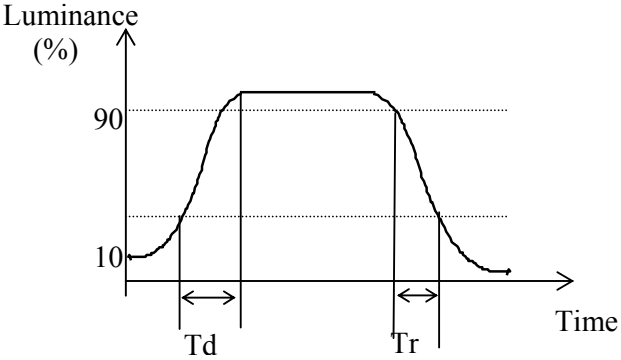| NO	ITEM	SYMBOL	CONDITION	LCD TYPE						REF.
				STN YG	STN GREY	STN -VE BLUE	FSTN +VE B/W	FSTN –VE BLUE	FSTN -VE TRUE B/W	
1	Operating Voltage (Volt)	V_{LCD}	$\theta = 0$ Cr = max	4.5 ± 5%						7.1.1
2	Viewing Angle (Deg)	$\theta x 1$	CR ≥ 2 V_{LCD} = 4.5V	+25	+20	+35	+25	+35	+35	7.1.2
		$\theta x 2$		-25	-20	-35	-25	-35	-40	
		$\theta y 1$		-30	-25	-35	-30	-35	-35	
		$\theta y 2$		+30	+25	+35	+30	+35	+35	
3	Contrast Ratio	CR	$\theta = 0^0$ 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)	$\theta = 0^0$	200						
		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	*Definition of Operating Voltage (V$_{LCD}$)*	V_{LCD} $1/F$ V$_{LCD}$: Operating Voltage F : Frame Frequency
7.1.2	*Definition of Viewing Angle*	θ REAR LEFT RIGHT FRONT BOTTOM REAR (θy2) LEFT(θx2) RIGHT(θx1) FRONT (θy1)

| 7.1.3	*Definition of Contrast Ratio*	NON-SELECT WAVE BRIGHTNESS (%) SELECT WAVE b a OPERATION VOLTAGE Contrast Ratio = <u>Brightness of non-selected state (b)</u> 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 (%) 90 10 Td Tr Time 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.

7

8.0   Interface

8.1	*Display Driver*	ST7066U and ST7063C or S6A0066U and S6A2067		
8.2	*Duty Cycle*	1/16		
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
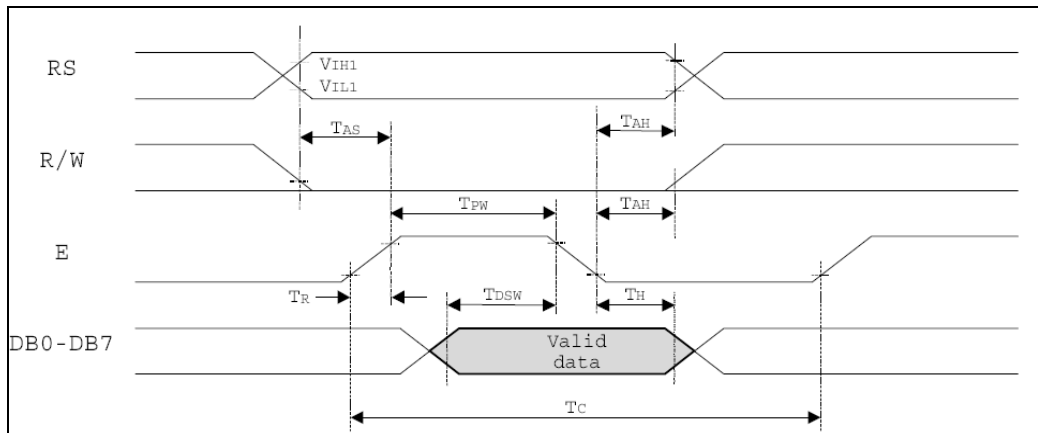
Write mode
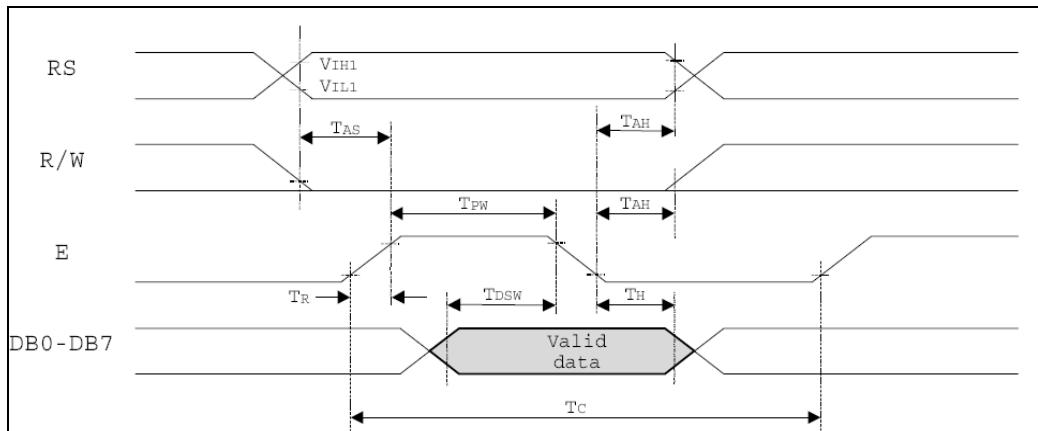
Read mode

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
Internal Clock Operation						
f_{OSC}	OSC Frequency	R = 91KΩ	190	280	350	KHz
External Clock Operation						
f_{EX}	External Frequency	-	125	280	350	KHz
	Duty Cycle	-	45	50	55	%
T_R, T_F	Rise/Fall Time	-	-	-	0.2	μs
Write Mode (Writing data from MPU to ST7066)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DSW}	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
Read Mode (Reading Data from ST7066 to MPU)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	100	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
Interface Mode with LCD Driver(ST7065)						
T_{CWH}	Clock Pulse with High	Pins: CL1, CL2	800	-	-	ns
T_{CWL}	Clock Pulse with Low	Pins: CL1, CL2	800	-	-	ns
T_{CST}	Clock Setup Time	Pins: CL1, CL2	500	-	-	ns
T_{SU}	Data Setup Time	Pin: D	300	-	-	ns
T_{DH}	Data Hold Time	Pin: D	300	-	-	ns
T_{DM}	M Delay Time	Pin: M	-1000	-	1000	ns
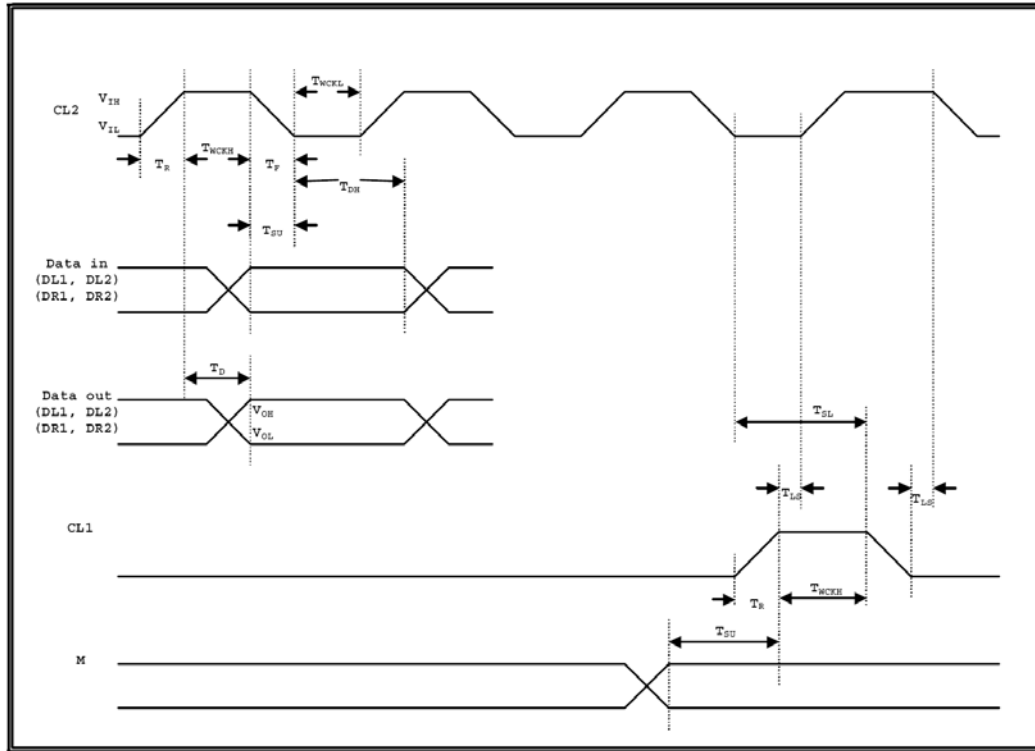
Interface with extension driver

| Symbol	Parameter	Test Condition	Min.	Max.	Unit	Applicable pin
FCL	Data Shift Frequency	-	-	400	KHZ	CL2
TWCKH	Clock High Level Width	-	800	-	ns	CL1,CL2
TWCKL	Clock Low Level Width	-	800	-	ns	CL2
TSL	Clock Set-up Time	CL2 → CL1	500	-	ns	CL1,CL2
TLS	Clock Set-up Time	CL1 → CL2	500	-	ns	CL1,CL2
TR/TF	Clock Rise/Fall Time	-	-	200	ns	CL1,CL2
TSU	Data Set-up Time	-	300	-	ns	DL1,DL2,DR1,DR2
TDH	Data Hold Time	-	300	-	ns	DL1,DL2,DR1,DR2
TD	Data Delay Time	CL = 15 PF	-	500	ns	DL1,DL2,DR1,DR2

10.0   Power Supply
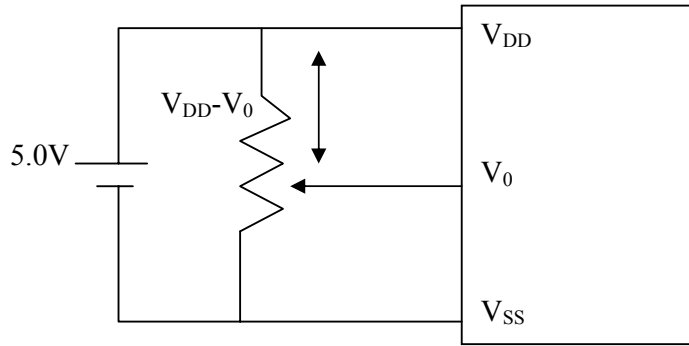
Where $V_{DD}-V_0 = $ LCD Driving voltage
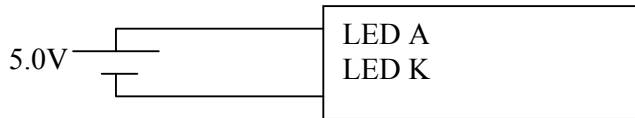
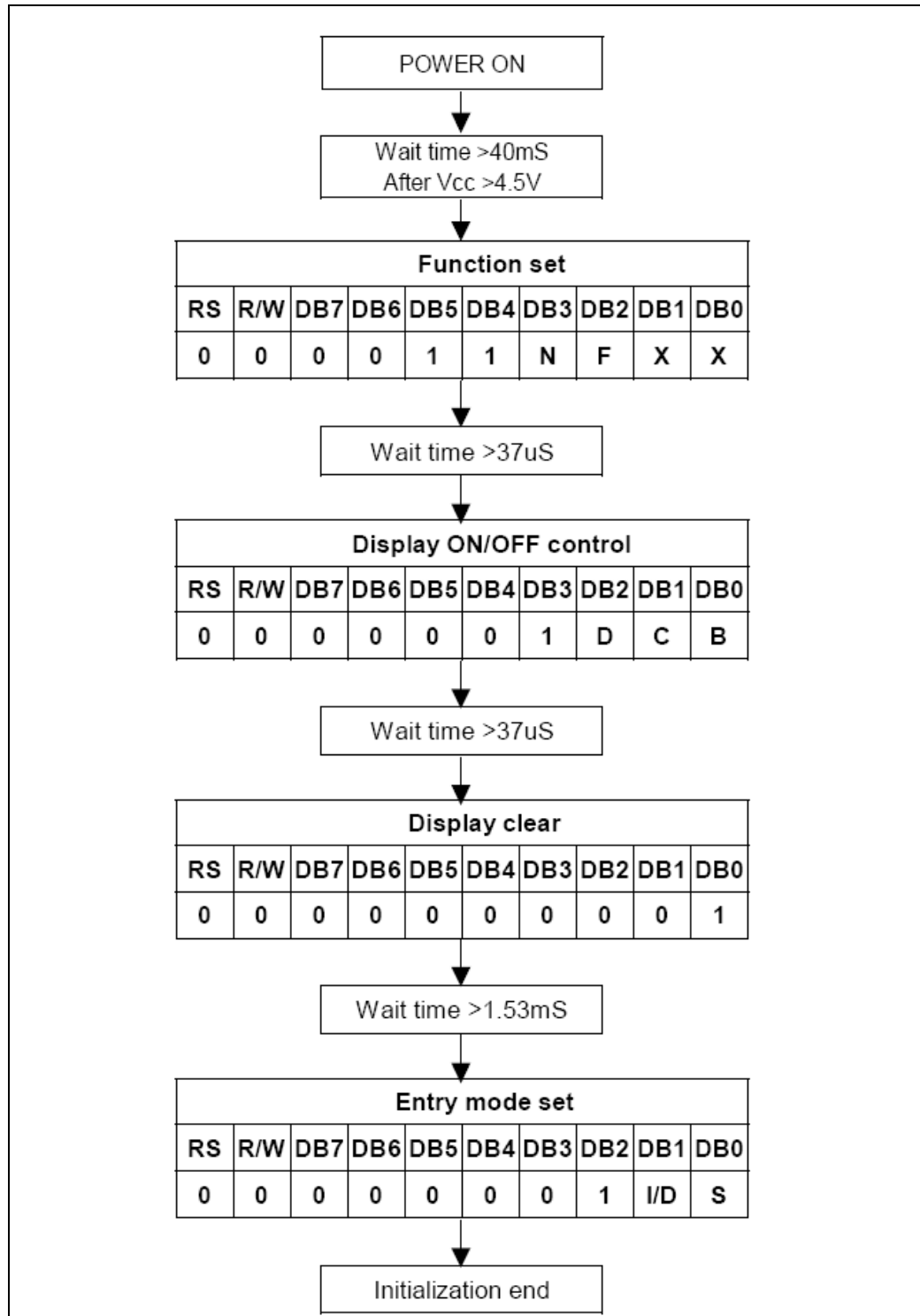For backlight version only

11.0   Block Diagram
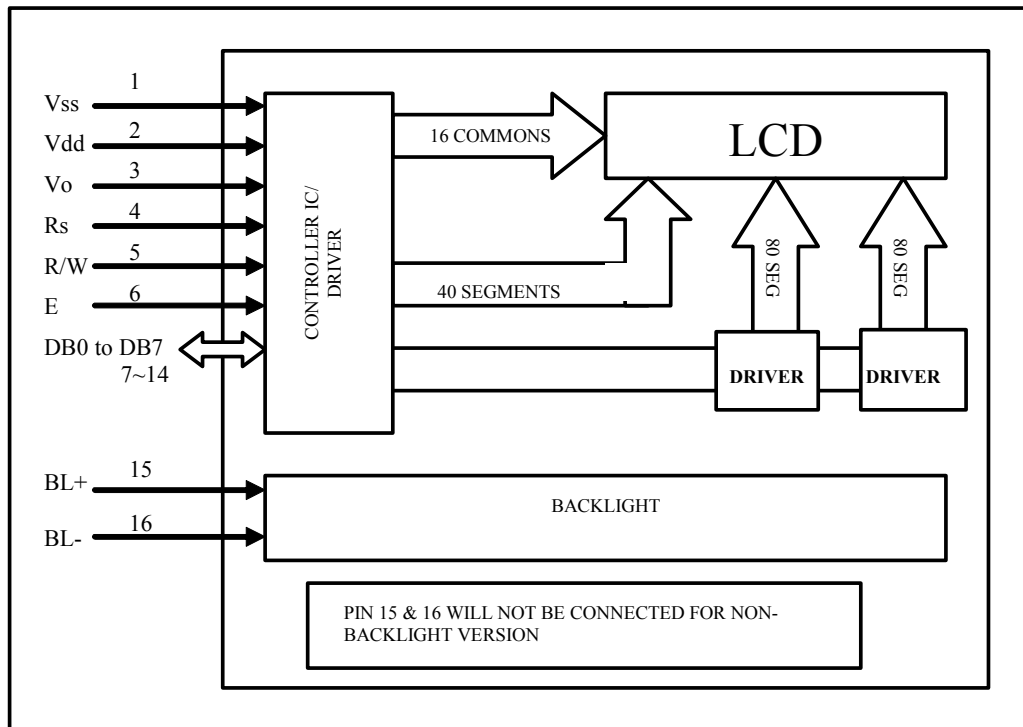
12.0   Instructions

Instruction	Instruction Code										Description	Description Time (270KHZ)
	RS	RW	DB 7	DB 6	DB 5	DB 4	DB 3	DB 2	DB 1	DB 0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.52 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.52 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	37 us
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1: entire display on C=1: cursor on B=1: cursor position on	37 us
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	37 us
Function Set	0	0	0	0	1	DL	N	F	x	x	DL: interface data is 8/4 bits NL: number of line is 2/1 F: font size is 5x11/5x8	37 us
Set CGRAM address	0	0	0	1	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0	Set CGRAM address in address counter	37 us
Set DDRAM address	0	0	1	AC 6	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0	Set DDRAM address in address counter	37 us
Read Busy flag and address	0	1	BF	AC 6	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0 us
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	37 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	37 us

8 bit operation example.

```
                    ┌─────────────────┐
                    │    POWER ON     │
                    └─────────────────┘
                             │
                             ▼
                    ┌─────────────────┐
                    │ Wait time >40mS │
                    │ After Vcc >4.5V │
                    └─────────────────┘
                             │
                             ▼
```

Function set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	N	F	X	X

Wait time >37uS

Display ON/OFF control

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	1	D	C	B

Wait time >37uS

Display clear

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	0	1

Wait time >1.53mS

Entry mode set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	1	I/D	S

```
                    ┌──────────────────┐
                    │ Initialization end│
                    └──────────────────┘
```

Relationship between character code (DDRAM) and character pattern (CGRAM)

Character Code (DDRAM Data)								CGRAM Address						Character Patterns (CGRAM Data)							
b7	b6	b5	b4	b3	b3	b1	b0	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	-	0	0	0	0	0	0	0	0	0	-	-	-	1	1	1	1	1
					0	0	0				0	0	1				0	0	1	0	0
					0	0	0				0	1	0				0	0	1	0	0
					0	0	0				0	1	1				0	0	1	0	0
					0	0	0				1	0	0				0	0	1	0	0
					0	0	0				1	0	1				0	0	1	0	0
					0	0	0				1	1	0				0	0	1	0	0
					0	0	0				1	1	1				0	0	0	0	0
0	0	0	0	-	0	0	1	0	0	0	0	0	0	-	-	-	1	1	1	1	0
					0	0	1				0	0	1				1	0	0	0	1
					0	0	1				0	1	0				1	0	0	0	1
					0	0	1				0	1	1				1	1	1	1	0
					0	0	1				1	0	0				1	0	1	0	0
					0	0	1				1	0	1				1	0	0	1	0
					0	0	1				1	1	0				1	0	0	0	1
					0	0	1				1	1	1				0	0	0	0	0

Character Generator ROM (ST7066U-0A-B)

13.0 Quality Assurance

13.1 ZONE DEFINITION

ZONE A

ZONE B
(Outside Viewing Area)

ZONE C
(Sealing Area)

EFFECTIVE VIEWING AREA
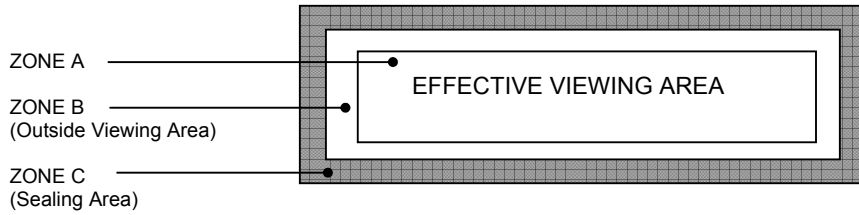
13.1.1 Black Spot, White Spot and Foreign Material

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	
		$D \leq 0.10$mm	NC	NC	NC	
		$0.10 < D \leq 0.20$mm	3	3	NC	
		$0.20 < D \leq 0.30$mm	1	2	NC	
		$D > 0.30$ mm	0	0	NC	
		NC: No count				
		D: Mean Diameter of Defect				

Drawing: $D = (A + B)/2$

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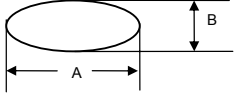
Defect Category	Defect Description	Criterion					Drawing Specification
Line shape and scratches	Line shape and scratches	Zone /Dimension		Acceptable No.			
		X	Y	A	B	C	
		-	<0.01mm	NC	NC	NC	
		< 2 mm	< 0.02mm	1	1	NC	
		<1 mm	< 0.0 2mm	1	2	NC	

13.1.3 Pin Hole

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

13.1.4 Polarizer Bubble/Foreign Material

Defect Category	Defect Description	Criterion				Drawing Specification
	Polarizer bubble / Foreign material					
		Zone /	Acceptable No.			
		Dimension	A	B	C	
		D ≤ 0.15mm	NC	NC	NC	
		0.15 < D ≤ 0.30mm	3	5	NC	
		0.30 < D ≤ 0.50mm	2	3	NC	
		0.50 < D ≤ 1.0mm	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				

Drawing Specification:

$D = (A + B)/2$

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.
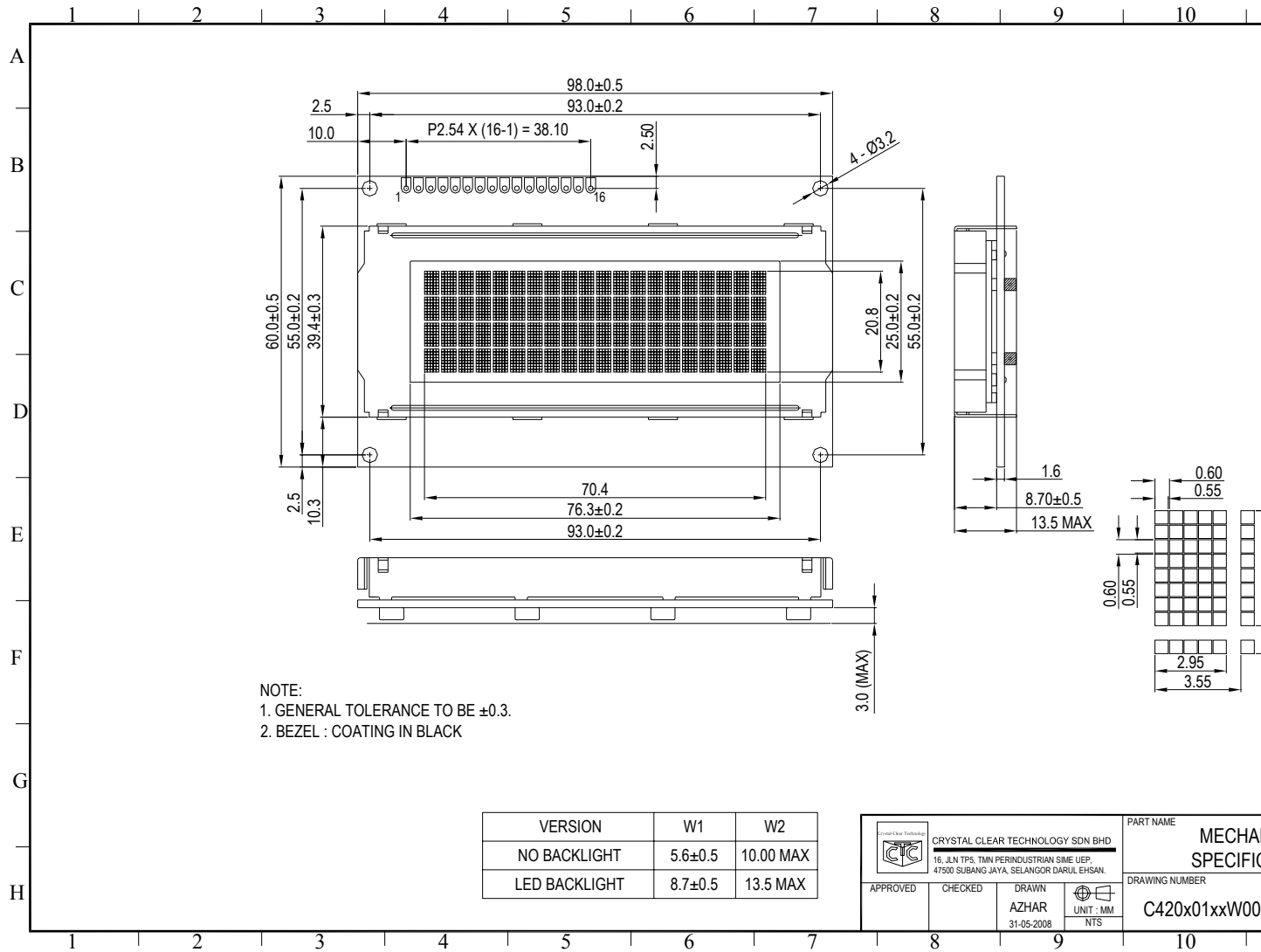
2.4 Operation

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.

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

VERSION	W1	W2
NO BACKLIGHT	5.6±0.5	10.00 MAX
LED BACKLIGHT	8.7±0.5	13.5 MAX

CRYSTAL CLEAR TECHNOLOGY SDN BHD 16, JLN TP5, TMN PERINDUSTRIAN SIME UEP, 47500 SUBANG JAYA, SELANGOR DARUL EHSAN.	PART NAME	MECHA... SPECIFIC...
APPROVED	CHECKED	DRAWN AZHAR 31-05-2008	UNIT : MM NTS	DRAWING NUMBER C420x01xxW00...

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

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for LCD Character Display Modules & Accessories *category:*

Click to view products by Crystal *manufacturer:*

Other Similar products are found below :

HG9Z-AC501 HG9Z-SCI25B HG9Z-XC300 LCD-S401M14TF LCM-H04002DWN-1G LCM-S01602DTRA-3 HDM16216L-S-L30S HG9Z-XC13A HG9Z-XC213 C216L01YBW00 LCM-S01602DSF/Q EA FL-10P MDLS-161612-G-LV-LED4G MDLS24265LVLED04 MDLS-20265-LV-GLED4G NHD-0420AZ-FSW-GBW-33V33-0 PC2004LRS-AWB-B-Q CM1644-SGR1 C216W01BBW00 C420W01NBW00 C220W04NBW00 C220L01YBWR00 C216N04YBW00 G64128W23NBW00 G64128W18NBW00 G64128Z24UBW00 G64128W20NBW00 G64128W20BBW00 G64128W22BBW00 G64128W25NBW00 162A BC BW LCM-S02002DSM-Y MOP-AL202C-BYFY-25E-3IN NHD-0416BZ-FL-GBW-SED 162D BA BC MDLS-20464-LV-GLED4G MDLS-40466-G-HV HDM24216H-2-P9XS MIKROE-4169 MDLS-82603-LV-G MDLS-16263-C-LV-G-LED01G-FFC VIM-404-DP-RC-S-HV LCD-S401M16KR LED4-20265 NHD-0440WH-ATFH-JT# EA 9907-DIP GLK12232A25SMUSBWBVSE GLK19264A-7T-1U-USB-FGW GLK19264A-7T-1U-USB-WB GLK12232A25SMUSBGWVSE