Crystal Clear Technology

Product Specification

G1624x01xxx00

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1.0 Table of Contents

2.0 Record of revision

Rev	Date	Item	Page	Comment	Originator	Checked By
1.0	24/9/10			Initial Release	Thorn	Azhar
2.0	07/09/12			Revise General Specification	Azhar	Azhar

3.0 General specification

Display format: Graphics 240 (w) x 160 (h) dots

Dot size: 0.185 (w) x 0.205 (h) mm

Dot pitch: 0.200 (w) x 0.220 (h) mm

View area: 47.985 (w) x 35.185 (h) mm

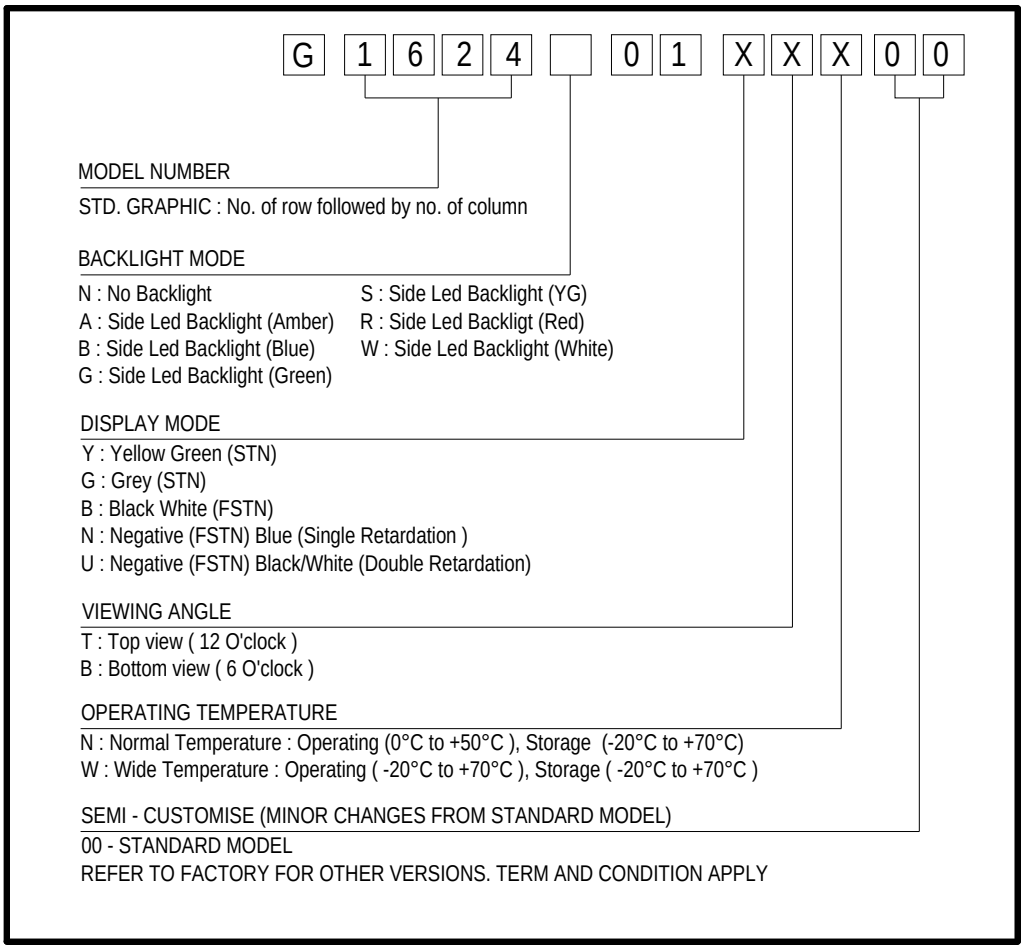
Active area: 56.0 (w) x 40.3 (h) mm

General dimensions: 62.5 (w) x 51.6 (h) x 4.2 (t – effective thickness)

Controller/Driver: ST7529 or equivalent

Interface: Parallel

Driving method: 1/160 duty, 1/14 bias



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

NO	ITEM	SIMBOL	MIN	MAX	UNIT
1.	Operating Voltage Range	V_{DD}	2.4	3.3	V
2.	Supply Voltage Range	V_{LCD}	-	18.0	V
3.	Input Voltage	V_{IN}	-	-	V
4.	Operating Temperature	T_{op}	Refer page 3		°C
5.	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)	$V_{DD} - V_{SS}$	-	-	3.0	-	V
2.	Power Supply voltage for LCD	$V_0 - V_{SS}$	25°C	16.7±5%			V
3.	Input Voltage	V_{IH}	-	$0.7V_{DD}$	-	V_{DD}	V
		V_{IL}	-	0	-	$0.3V_{DD}$	V
4.	Current Supply	I_{DD}	$V_{DD} - V_{SS}$ =3.0V	-	0.18	0.25	mA

*Note: Point 2, power supply voltage for LCD functions as a reference voltage. CCT is to set samples limit for contrast programming at factory level. This is to ensure consistent contrast ratio for all production LCD.

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	-	3.9	-	-	40	50	30

*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: 20000 hours

6.0 Environmental and Reliability requirements

NO	ITEM	CONDITION
1.	Operating Temperature	Refer page 3
2.	Storage Temperature	Refer page 3
3.	Operating Humidity	Up to 90%RH
4.	Lifetime	50000 HOURS (excluding backlight)

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

TEST DESCRIPTION	TEST PARAMETERS	LCD	LCM
Temperature Cycle Operation	1 cycle = 0ºC for 30 minutes, +50ºC for 30minutes. Perform 10 cycles. LCM in operation.	N/A	Yes
Temperature Cycle Storage	1 cycle = -20ºC for 30 minutes, +70ºC for 30minutes. Perform 10 cycles. LCM in non-operation.	N/A	Yes
Boiling	LCD without polarizer. Boil LCD at 100ºC @ 100% RH for 40 hours	Yes	N/A
Humidity Operation	+40ºC at 90~95% RH for 250hours. *Applicable when fail boiling test	N/A	Yes

Note: Applicable to prototype and pre-production.

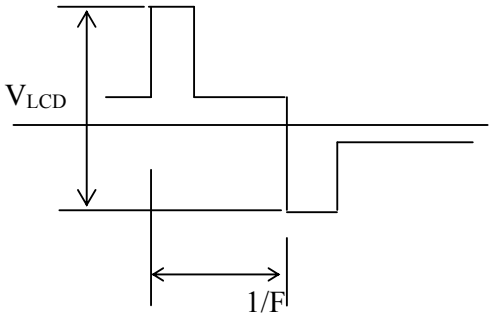
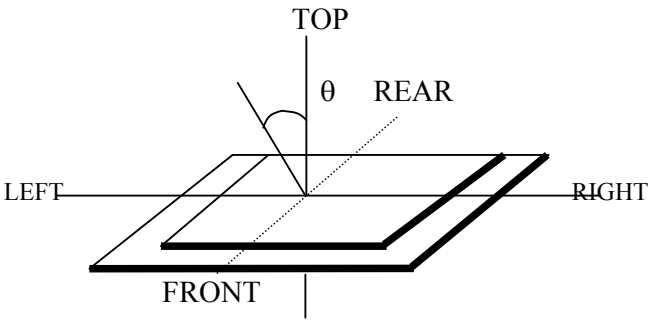
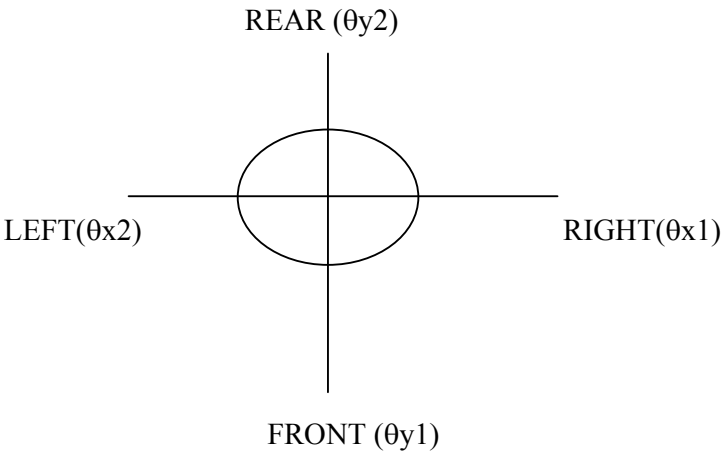
7.0 LCD specification

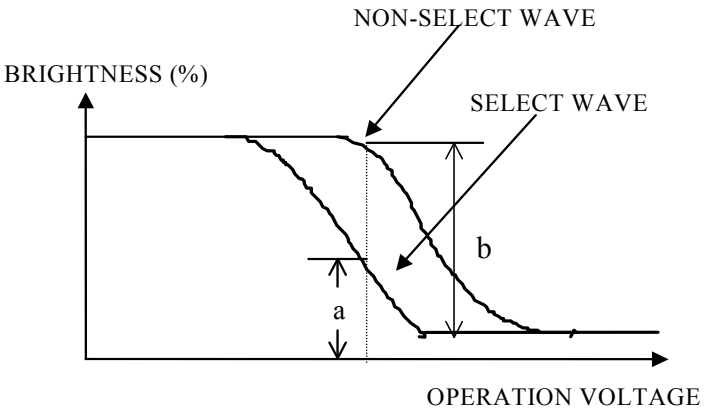
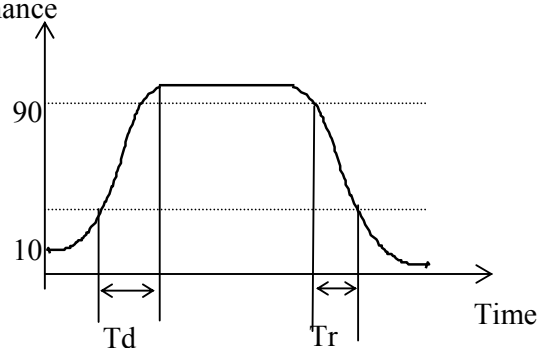
7.1 Electro-optical characteristics (at ambient temperature = 25°C)

NO	ITEM	SYMBOL	CONDITION	LCD TYPE	REF.
				POSITIVE FSTN BLACK/WHITE	
1	Operating Voltage (Volt)	V_{LCD}	θ = 0 Cr = max	16.7	7.1.1
2	Viewing Angle (Deg)	θ x 1	CR ≥ 2 V_{LCD} = 16.7V	+20	7.1.2
		θ x 2		-20	
		θ y 1		-25	
		θ y 2		+25	
3	Contrast Ratio	CR	θ = 0^0 V_{LCD} =16.7V	2.5	7.1.3
4	Response Time (msec)	Rise Time (Tr)	θ = 0^0	350	7.1.4
		Decay Time (Td)	θ = 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	***Definition of Operating Voltage (V_{LCD})***	 V_{LCD} : Operating Voltage F : Frame Frequency
7.1.2	***Definition of Viewing Angle***	 

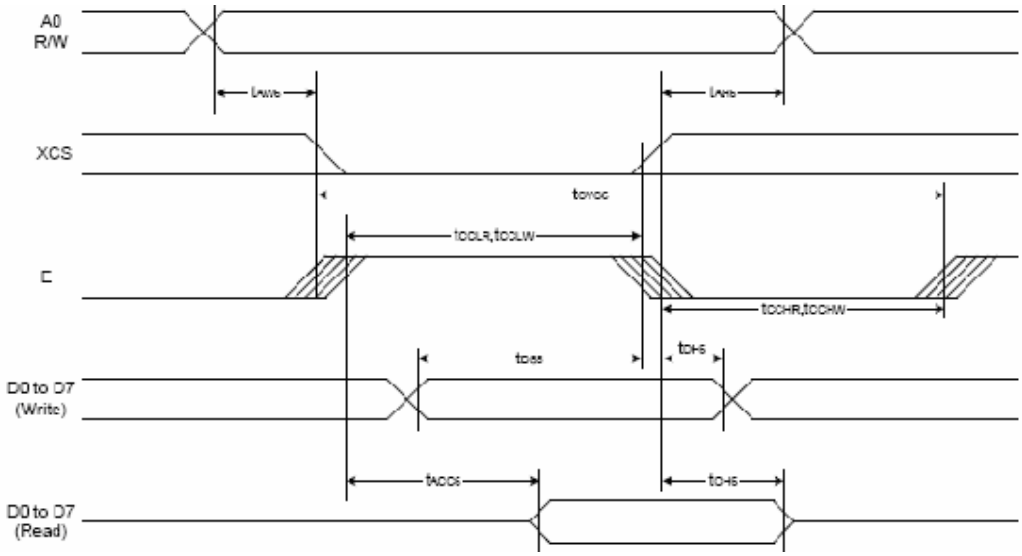
7.1.3	***Definition of Contrast Ratio***	 Contrast Ratio = Brightness of non-selected state (b) / Brightness of selected state (a) ***Conditions*** (a) Operating Voltage: V_{LCD} (b) Temperature: 25°C (c) Viewing Angle, $\theta = 0^o$
7.1.4	*Response Time*	Luminance (%)  Tr: Measured between 10% and 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	***Controller/Driver***	ST7529-G	
8.2	***Duty Cycle***	1/64	
8.3	***Pin out Assignments***		
	Pin No	**Symbol**	**Description**
	1	LEDA	Anode of LED
	2	LEDA	Anode of LED
	3	LEDK	Cathode of LED
	4	LEDK	Cathode of LED
	5	V0	Logic Driver Supply Voltages
	6	V1	Logic Driver Supply Voltages
	7	V2	Logic Driver Supply Voltages
	8	V3	Logic Driver Supply Voltages
	9	V4	Logic Driver Supply Voltages
	10	VLCD	LCD Supply Voltage
	11	C6P	DCDC Voltage Converter
	12	C2N	DCDC Voltage Converter
	13	C4P	DCDC Voltage Converter
	14	C2P	DCDC Voltage Converter
	15	C1P	DCDC Voltage Converter
	16	C3P	DCDC Voltage Converter
	17	C5P	DCDC Voltage Converter
	18	C1N	DCDC Voltage Converter
	19	C7P	DCDC Voltage Converter
	20	VDDA	Power Supply for LCD
	21	VSS	Ground
	22	VDD	Power Supply
	23	XCS	Chip Select Input Pins
	24	SCL	Serial Clock
	25	SI	Serial Data
	26	IF3	Parallel / Serial data input select input
	27	IF2	Parallel / Serial data input select input
	28	IF1	Parallel / Serial data input select input
	29	/RST	Reset Input Pin
	30	/RD	Read / Write execution control pin
	31 ~ 38	D7 ~ D0	8-bit MPU bus via the 8-bit bi-directional bus
	39	/WR	Read / Write execution control pin
	40	A0	Register select input pin

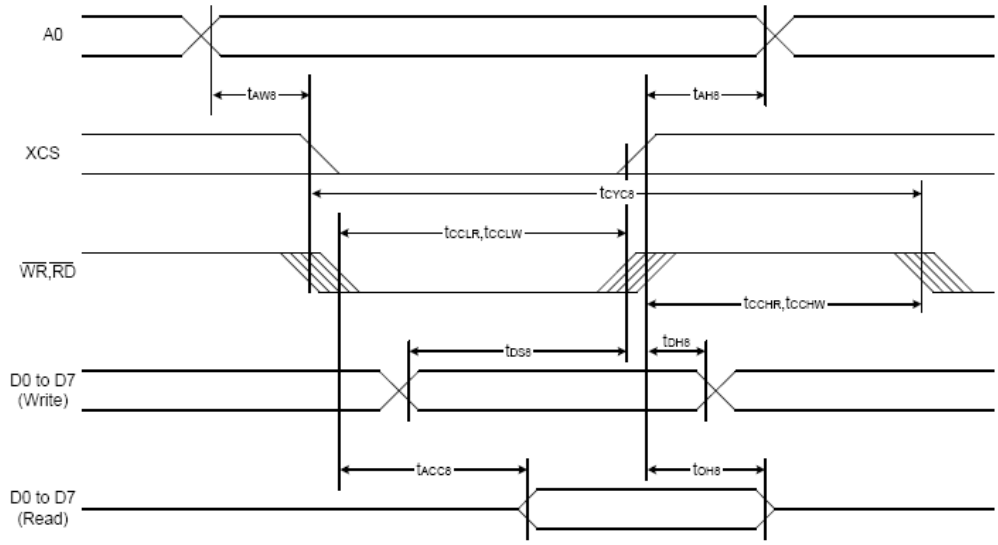
9.0 Functional Descriptions

9.1 Read/Write timing characteristics



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAH6	-	20	-	ns
Address setup time		tAW6	-	20	-	
System cycle time		tCYC6	-	200	-	
Enable L pulse width (WRITE)	WR	tEWLW	-	100	-	
Enable H pulse width (WRITE)		tEWHW	-	100	-	
Enable L pulse width (READ)	RD	tEWLR	-	100	-	
Enable H pulse width (READ)		tEWHR	-	100	-	
WRITE Data setup time	D0 to D7	tDS6	-	150	-	
WRITE Address hold time		tDH6	-	20	-	
READ access time		tACC6	CL = 100 pF	-	40	
READ Output disable time		tOH6	CL = 100 pF	-	30	

Read/Write characteristics (6800 series MPU)

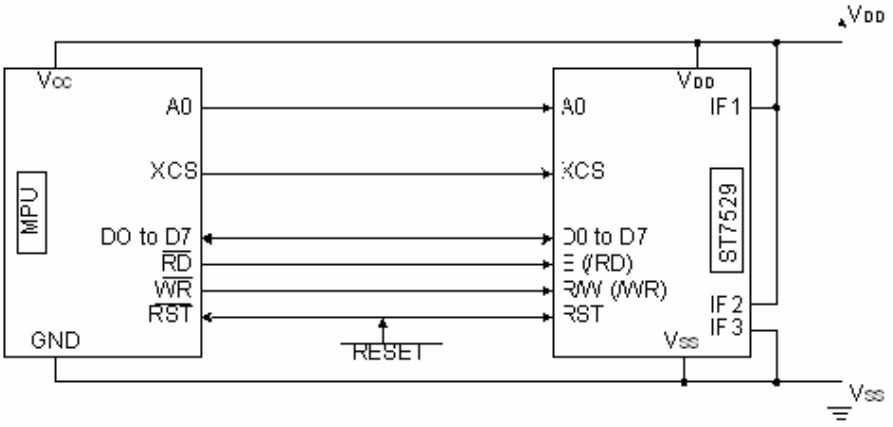


Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAH8	-	20	-	ns
Address setup time		tAW8	-	20	-	
System cycle time		tCYC8	-	200	-	
Enable L pulse width (WRITE)	WR	tCCLW	-	100	-	
Enable H pulse width (WRITE)		tCCHW	-	100	-	
Enable L pulse width (READ)	RD	tCCLR	-	100	-	
Enable H pulse width (READ)		tCCHR	-	100	-	
WRITE Data setup time	D0 to D7	tDS8	-	150	-	
WRITE Address hold time		tDH8	-	20	-	
READ access time		tACC8	CL = 100 pF	-	40	
READ Output disable time		tOH8	CL = 100 pF	-	30	

Read/Write characteristics (8080 series MPU)

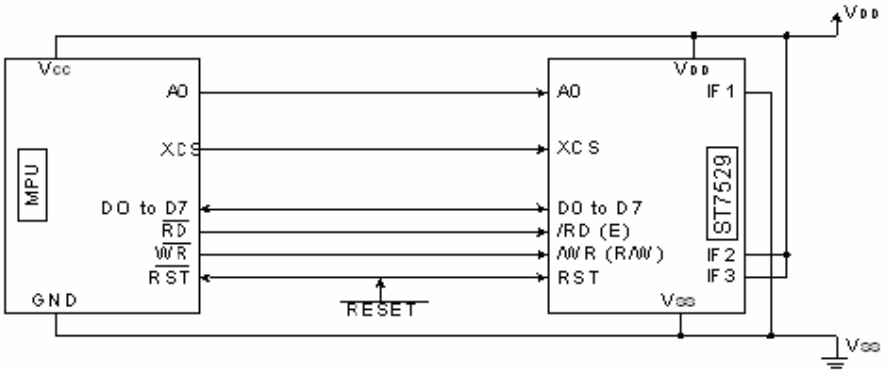
9.2 Application Circuits

9.2.1 6800 – Series Parallel Interface



Note: Internally LCD's IF2 pin is pull-high

9.2.2 8080 – Series Parallel Interface



Note: Internally LCD's IF2 pin is pull-high

9.3 EEPROM Read function

To mitigate large tolerance in IC's and LCD's Vop, it is recommended for user to read a factory pre-store contrast adjustment value for better display contrast. The following are the brief procedure in reading the EEPROM.

Example：EEPROM Read Operation

```
void ReadEEPROM( void )
    {

        Write( COMMAND, 0x0030 );          // Ext = 0
        Write( COMMAND, 0x0007 );          // Initial code (1)
        Write( DATA, 0x0019 );
        Write( COMMAND, 0x0031 );          // Ext = 1
        Write( COMMAND, 0x00CD );          // EEPROM ON
        Write( DATA, 0x0000 );             // Entry "Read Mode"
        Delay( 100ms );                    // Waite for EEPROM Operation ( 100ms )
        Write( COMMAND, 0x00FD );          // Start EEPROM Reading Operation
        Delay( 100ms );                    // Waite for EEPROM Operation ( 100ms )
        Write( COMMAND, 0x00CC );          // Exist EEPORM Mode
        Write( COMMAND, 0x0030 );          // Ext = 0

    }
```

10. Instruction Set

Ext=0 or Ext=1

Index	Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function	Hex	Parameter
1	Ext In	0	1	0	0	0	1	1	0	0	0	0	Ext=0 Set	30	None
2	Ext Out	0	1	0	0	0	1	1	0	0	0	1	Ext=1 Set	31	None

Ext=0

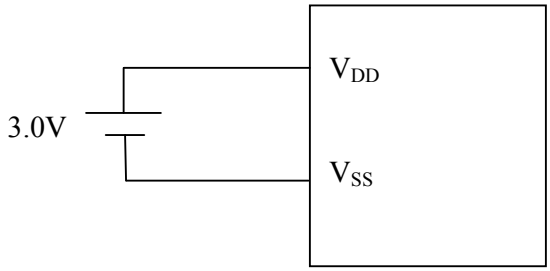
Index	Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function	Hex	Parameter
1	DISON	0	1	0	1	0	1	0	1	1	1	1	Display On	AF	None
2	DISOFF	0	1	0	1	0	1	0	1	1	1	0	Display Off	AE	None
3	DISNOR	0	1	0	1	0	1	0	0	1	1	0	Normal Display	A6	None
4	DISINV	0	1	0	1	0	1	0	0	1	1	1	Inverse Display	A7	None
5	COMSCN	0	1	0	1	0	1	1	1	0	1	1	COM Scan Direction	BB	1 byte
6	DISCTRL	0	1	0	1	1	0	0	1	0	1	0	Display Control	CA	3 bytes
7	SLPIN	0	1	0	1	0	0	1	0	1	0	1	Sleep In	95	None
8	SLPOUT	0	1	0	1	0	0	1	0	1	0	0	Sleep Out	94	None
9	LASET	0	1	0	0	1	1	1	0	1	0	1	Line Address Set	75	2 bytes
10	CASET	0	1	0	0	0	0	1	0	1	0	1	Column Address Set	15	2 bytes
11	DATSDR	0	1	0	1	0	1	1	1	1	0	0	Data Scan Direction	BC	3 bytes
12	RAMWR	0	1	0	0	1	0	1	1	1	0	0	Writing to Memory	5C	Data
13	RAMRD	0	1	0	0	1	0	1	1	1	0	1	Reading from Memory	5D	Data
14	PTLIN	0	1	0	1	0	1	0	1	0	0	0	Partial display in	A8	2 bytes
15	PTLOUT	0	1	0	1	0	1	0	1	0	0	1	Partial display out	A9	None
16	RMWIN	0	1	0	1	1	1	0	0	0	0	0	Read and Modify Write	E0	None
17	RMWOUT	0	1	0	1	1	1	0	1	1	1	0	RMW end	EE	None
18	ASCSET	0	1	0	1	0	1	0	1	0	1	0	Area Scroll Set	AA	4 bytes
19	SCSTART	0	1	0	1	0	1	0	1	0	1	1	Scroll Start Set	AB	1 byte
20	OSCON	0	1	0	1	1	0	1	0	0	0	1	Internal OSC on	D1	None
21	OSCOFF	0	1	0	1	1	0	1	0	0	1	0	Internal OSC off	D2	None
22	PWRCTRL	0	1	0	0	0	1	0	0	0	0	0	Power Control	20	1 byte
23	VOLCTRL	0	1	0	1	0	0	0	0	0	0	1	EC control	81	2 bytes
24	VOLUP	0	1	0	1	1	0	1	0	1	1	0	EC increase 1	D6	None
25	VOLDOWN	0	1	0	1	1	0	1	0	1	1	1	EC decrease 1	D7	None
26	RESERVED	0	1	0	1	0	0	0	0	0	1	0	Not Use	82	0
27	EPSRRD1	0	1	0	0	1	1	1	1	1	0	0	READ Register1	7C	None

28	EPSRRD2	0	1	0	0	1	1	1	1	1	0	1	READ Register2	7D	None
29	NOP	0	1	0	0	0	1	0	0	1	0	1	NOP Instruction	25	None
30	STREAD	0	0	1	Read Data								Status Read		
31	EPINT	0	1	0	0	0	0	0	0	1	1	1	Initial code(1)	07	1 byte

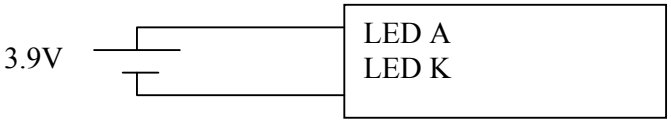
Ext=1

Index	*Command*	*A0*	*RD*	*WR*	*D7*	*D6*	*D5*	*D4*	*D3*	*D2*	*D1*	*D0*	*Function*	*Hex*	*Parameter*
1	Gray 1 Set	0	1	0	0	0	1	0	0	0	0	0	FRAME 1 Gray PWM Set	20	16 bytes
2	Gray 2 Set	0	1	0	0	0	1	0	0	0	0	1	FRAME 2 Gray PWM Set	21	16 bytes
3	ANASET	0	1	0	0	0	1	1	0	0	1	0	Analog Circuit Set	32	3 bytes
4	SWINT	0	1	0	0	0	1	1	0	1	0	0	Software Initial	34	None
5	EPCTIN	0	1	0	1	1	0	0	1	1	0	1	Control EEPROM	CD	1 byte
6	EPCOUT	0	1	0	1	1	0	0	1	1	0	0	Cancel EEPROM	CC	None
7	EPMWR	0	1	0	1	1	1	1	1	1	0	0	Write to EEPROM	FC	None
8	EPMRD	0	1	0	1	1	1	1	1	1	0	1	Read from EEPROM	FD	None

11. Power Supply

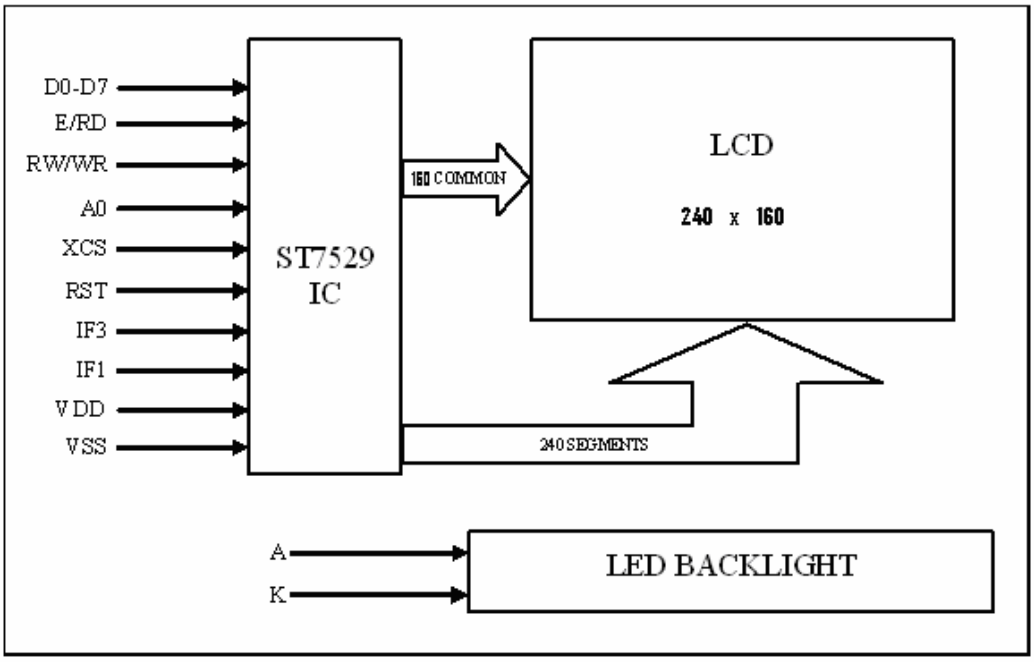


Note: This module must provide supply externally to VLCD pin (pin #7 – 15V Max). This module is not able to provide internal boosting.



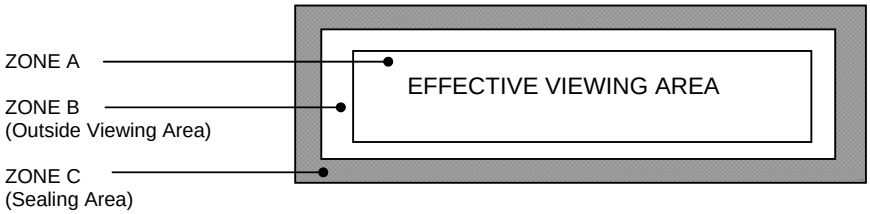
Note: For backlight

12. Block Diagram



13.0 Quality Assurance

13.1 ZONE DEFINITION

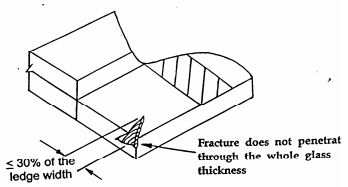


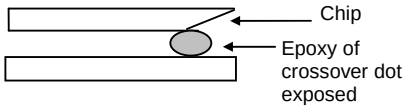
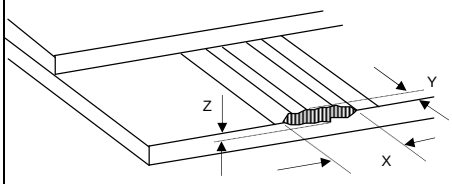
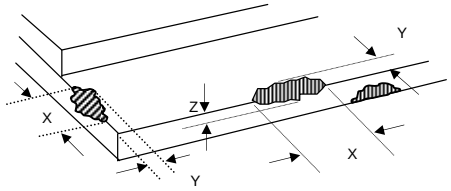
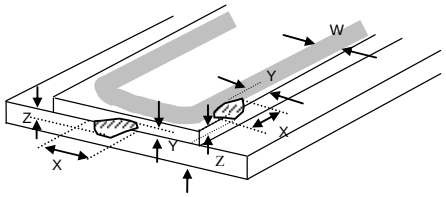
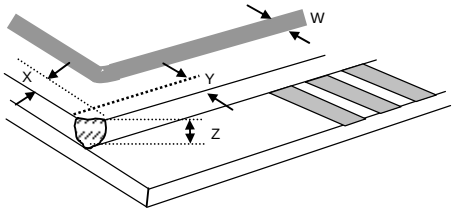
13.2 REJECTION CRITERIA

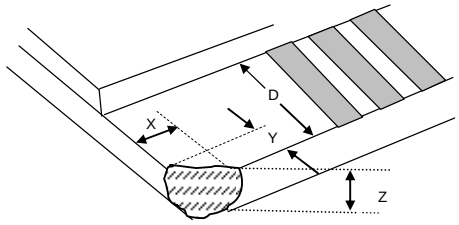
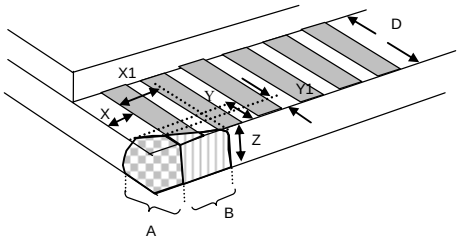
13.2.1 DIMENSIONAL DEFECTS

Defect Category	Defect Description	Criterion	Drawing Specification
Glass Size	Dimensions of LCD, do not conform to the drawing	Reject	Refer to LCD Physical Dimension Drawing
Perimeter Seal Extension	Perimeter seal epoxy enters the effective viewing area	Reject	
End Seal Size	Size of end seal does not meet drawing specification	Reject	Refer to LCD Physical Dimension Drawing

13.2.2 VISUAL DEFECTS

Defect Category	Defect Description	Criterion	Drawing Specification
Fracture	A type of glass breakage containing running cracks. Inspectors should attempt to remove it with fingernail. If removed, evaluate as chip	Reject – if the size is ≥ 30% of the contact ledge width.	

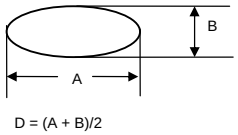
Defect Category	Defect Description	Criterion	Drawing Specification
Chip	Chip in cross over area	1) Reject - if the chip causes crossover dot to be exposed 2) Chip on outside edge of the glass plate but is greater than 50% of glass thickness at crossover dot is reject able.	
Chip	Chip in contact pad area	Accept if:- a) X ≤ 2.0mm b) Y ≤ 0.5mm c) Z disregard	
	Chip in non-contact pad area	Accept if:- a) X ≤ 6.0mm b) Y ≤ 1.0mm c) Z disregard	
	Chip in perimeter seal area	Accept if:- a) Y ≤ 1/3 of perimeter seal width (W) b) X ≤ 3.0mm c) Z disregard d) X and Y not touch crossover dot	
Corner Chip	Corner chip within seal area	Accept if:- a) X ≤ 1/3 of perimeter seal width (W) b) Y ≤ 1/3 of perimeter seal width (W) c) Z disregard	

Defect Category	Defect Description	Criterion	Drawing Specification
	Corner chip not effecting contact pad / ITO	Accept if:- a) XY ≤ 4mm^2 AND b) Y ≤ D and X ≤ 2.0mm c) Z disregard	
	Corner chip effecting contact pad / ITO	A) Accept if:- a) XY ≤ 4mm^2 AND b) Y ≤ D and X ≤ 2.0mm B) Accept if:- a) X1 ≤ 2.0mm b) Y1 ≤ 0.5mm Z disregard	
Glass flare	A thin layer of glass flare at contact area	Accept if:- a) Flare thickness ≤ ¼ W when W ≤ 3mm b) Flare thickness ≤ 1mm when W > 3mm W: Contact ledge width	
Glass burr	A rough edge(s) left along the scribing edge (i.e. along the edges of display)	Reject – if the burr cause undersize or oversize of the LCD	Refer to LCD Physical Dimension Drawing
Rainbow	Colored ring in sharp blotches observed	Reject – if 3 or more colored rings in sharp blotches of color are observed. (Limit samples should be used when applicable)	

Defect Category	Defect Description	Criterion	Drawing Specification
Discoloration		Reject - if the discolorations enter the active viewing area of LCD. Color of the LCD shall follow product specification as specified in the manufacturing specification	
Air Void	LC does not fulfill the display	Reject	
Fill end contamination	Discoloration at end seal area	Reject if discoloration exceeded the baffle (for display with baffle) or viewing area (for display without baffle)	

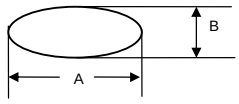
13.2.3 POLARIZER DEFECT

Defect Category	Defect Description	Criterion	Drawing Specification
Polarizer defect	Polarizer coverage	1- Polarizer should cover effective viewing area of display. 2- It is acceptable if perimeter seal bolder at all sides could be seen. 3- It is acceptable if polarizer attaching position meeting the tolerance mentioned in the drawing. 4- It is reject able if polarizer edge jagged and not even	Refer to LCD Physical Dimension Drawing
	Polarizer Peeling / delamination	1- Reject if any edge or corner of the polarizer is lifted up or not adheres to the glass	
	Polarizer Scratches	1- Any scratch should be acceptable if it is not visible from viewing distance at head of position 2-Polarizer scratch in viewing area is reject able if it is visible from the specified viewing distance 3-Defect, which is visible under surface glare, should be disregard	
	Polarizer damage	1-Stain mark or depression in front polarizer surface should be acceptable if it is not visible from viewing distance at head on position. 2-Defect, which is visible under surface glare, should be disregard	

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

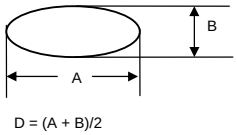
D = (A + B)/2</td></tr>
</table>

13.2.4 FUNCTIONAL DEFECT

Defect Category	Defect Description	Criterion	Drawing Specification
Missing common	Part of the pattern does not light up	Reject	
Missing segment	One or few segment does not light up	Reject	
Common-common short	Common and common connected	Reject	
Segment-segment short	Segment and segment connected	Reject	
Common – segment short	Common and segment connected	Reject	
Wrong viewing angle	Wrong viewing angle	Reject if display viewing angle not conform to customer requirement	
Metal residue	Extra spot lights up at the border of the segment.	Accept if ≤ 0.20mm (mean diameter)	
Slow response	Response of the display on one side slower than the other side	Reject if it is visible at 30cm distance	
Reverse twist/ tilt	Segment are darker or clearer than other area of the same segment	Reject	
Misalignment	Segment fatter or smaller or extra segment	Reject if > 10% of designed segment width and visible at 30cm distance	
Pin Hole	Pin hole / void at light up segment	<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 ≤ 0.10mm</td><td>NC</td><td>NC</td><td>NC</td></tr><tr><td>0.10<D ≤ 0.20mm</td><td>3</td><td>3</td><td>NC</td></tr><tr><td colspan="4">NC: No count D: Mean Diameter of Defect</td></tr></table>	 D = (A + B)/2

Defect Category	Defect Description	Criterion	Drawing Specification
Segment Smearing	Light up segment smear	Reject	
Dim segment	Display shows poor contrast at pre set voltage	Reject	

13.2.5 BLACK SPOT, WHITE SPOT AND FOEREIGN 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				

13.2.6 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	

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

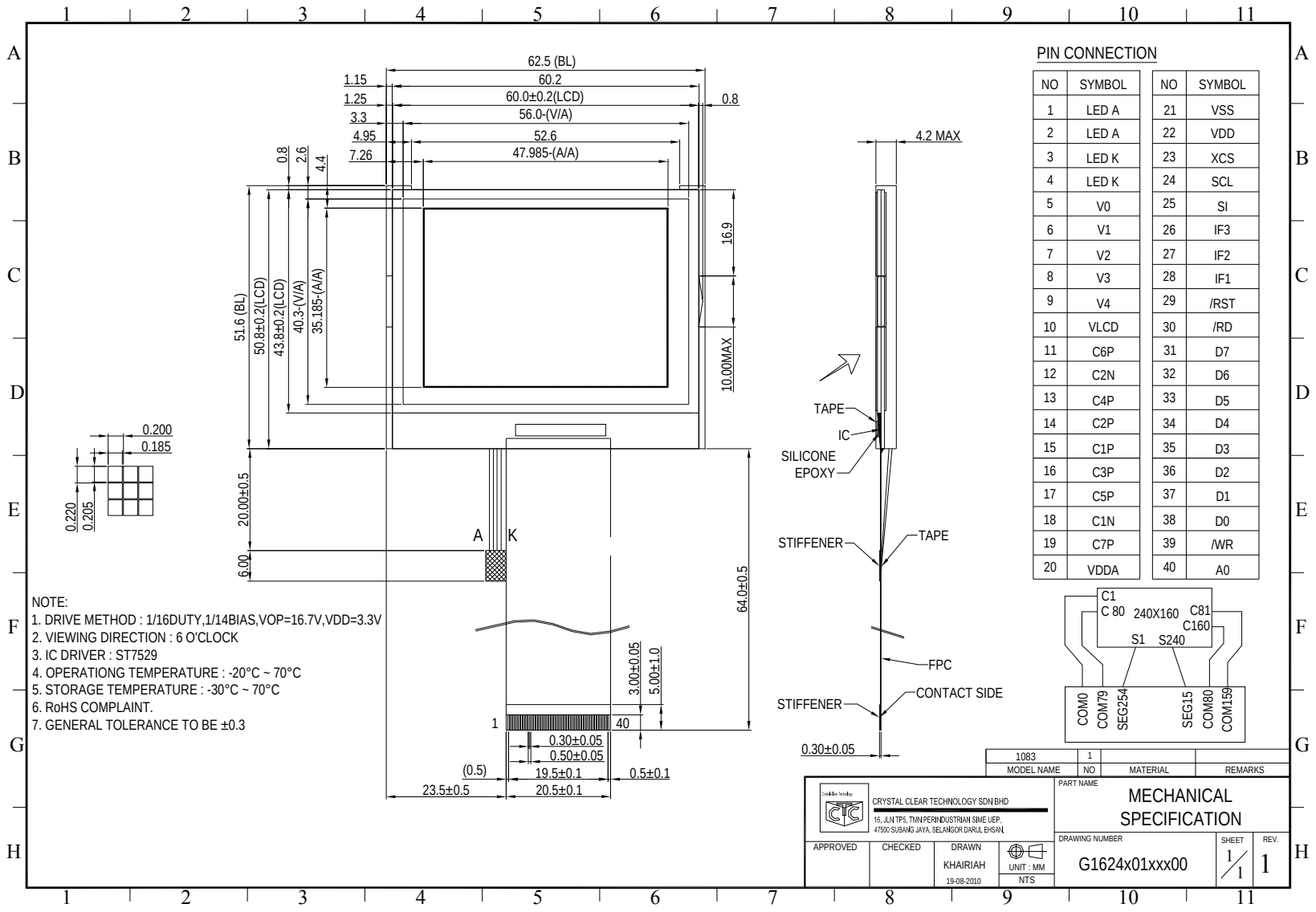
a) The contras can be adjusted by varying the LCD driving voltage V0
b) Driving voltage should be kept within specified range, excess voltage shortens display life.
c) Response time increases with decrease in temperature.
d) Display may turn black or dark blue at temperature above its operational range,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

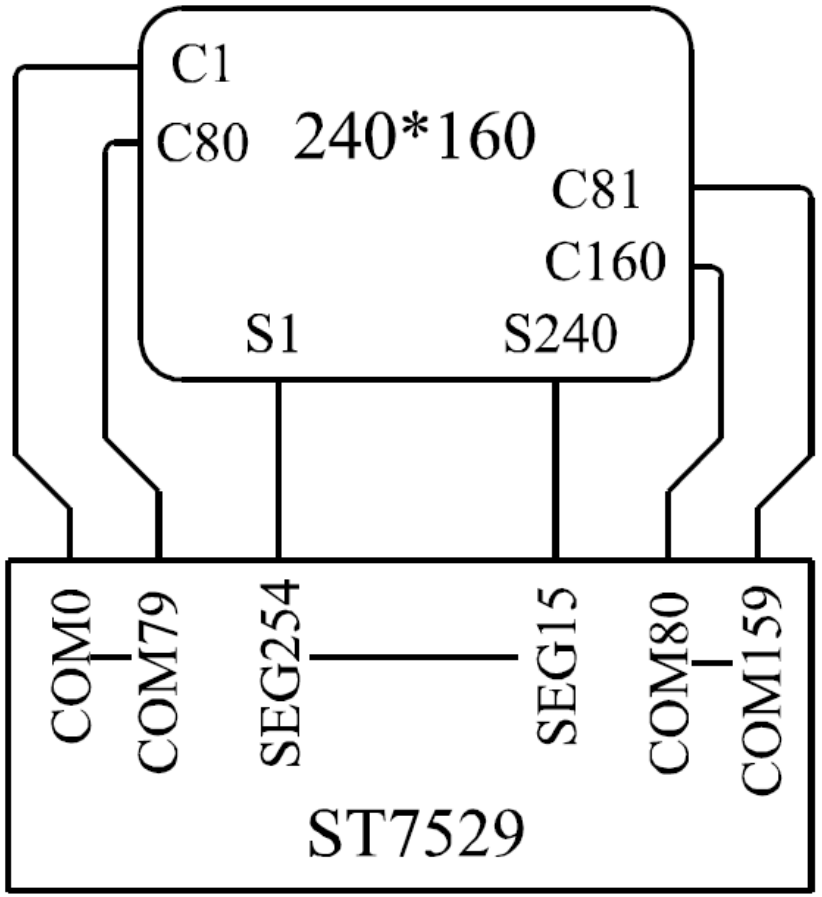
If any fluid leaks out of the damage glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

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.



NO	SYMBOL	NO	SYMBOL
1	LED A	21	VSS
2	LED A	22	VDD
3	LED K	23	XCS
4	LED K	24	SCL
5	V0	25	SI
6	V1	26	IF3
7	V2	27	IF2
8	V3	28	IF1
9	V4	29	/RST
10	VLCD	30	/RD
11	C6P	31	D7
12	C2N	32	D6
13	C4P	33	D5
14	C2P	34	D4
15	C1P	35	D3
16	C3P	36	D2
17	C5P	37	D1
18	C1N	38	D0
19	C7P	39	/WR
20	VDDA	40	A0


C1
C80
240*160
C81
C160
S1
S240
COM0
COM79
SEG254
SEG15
COM80
COM159
ST7529

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