

Crystal Clear Technology

Product Specification

G1619x02 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

	Page
1. Table of Contents	1
2. Record of revision	2
3. General specification	3
4. Absolute maximum ratings	4
5. Electrical characteristics	4
6. Environmental requirement	4
7. LCD specification	5 ~ 7
8. Interface	8
9. Timing characteristics / Timing diagrams	9 ~ 11
10. Memory Map	12 ~ 13
11. Command Summary	13 ~ 15
12. Initialization	15 ~ 16
13. Power Supply	17
14. Quality assurance	18 ~ 25
15. Precautions in use LCM	26 ~ 27
16. Outline drawing	28 ~ 30



2.0 Record of revision

Rev	Date	Item	Page	Comment	Originator	Checked By
1.0	30/06/08			Initial Release	Syam	Azhar
2.0	15/07/08	16	29	1.Addition of module drawing without touch panel	Syam	Jack
		1	1	2. Change table of content		



3.0 General specification

Display format: Graphics, 160 (H) x 192 (W)

Pixel size: 0.30 (H) x 0.30 (W) mm

Pixel pitch: 0.32 (H) x 0.32 (W) mm

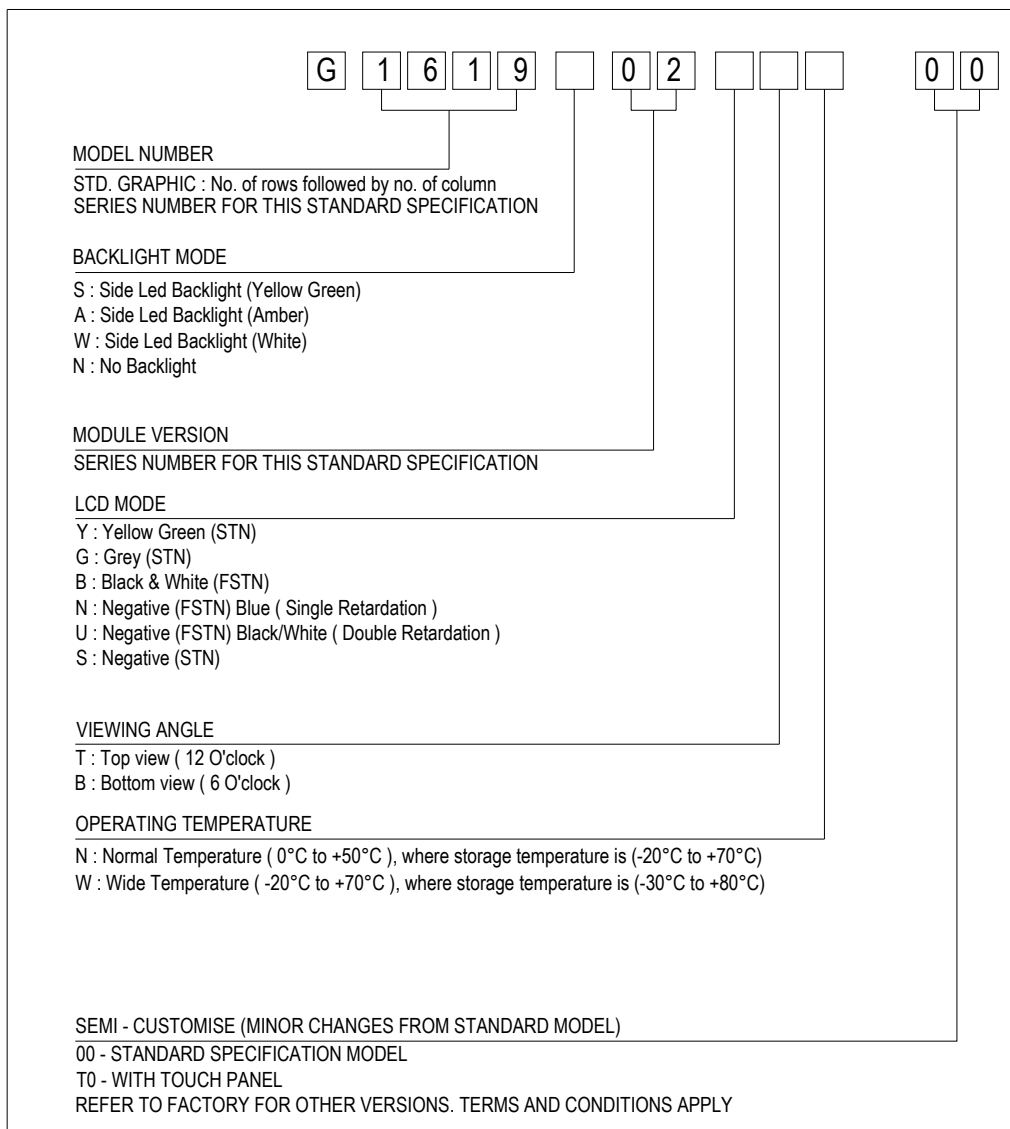
View area: 55.0 (H) x 65.0 (W) mm

Active area: 51.18 (H) x 61.42 (W) mm

General dimensions: 67.0 (H) x 80.5 (W) x 5.1 (T) mm (excluding FPC)

Controller/Driver: ST7529 TAB or equivalent

Interface: FPC ZIF-end connector, Parallel Interface



**4.0 Absolute maximum rating (at V_{SS} = 0V, ambient temperature = 25°C)**

NO	ITEM	SIMBOL	MIN	MAX	UNIT
1.	Power Supply voltage (Logic)	V _{DD} - V _{SS}	0	4.0	V
2.	Power Supply voltage (LCD Driver)	V _{DD} - V ₀	-	20.0	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}	-	2.4	-	3.3	V
2.	Power Supply voltage (V _{LCD})	V _{DD} - V ₀	25°C	18.0±5%			V
3.	Input Voltage	V _{IH}	-	0.8V _{dd}	-	V _{dd}	V
		V _{IL}	-	0	-	0.2V _{dd}	V
4.	Current Supply	I _{DD}	V _{DD} - V _{SS} = 3.3V	-	25	40	mA

5.1 Backlight Options

NO	COLOR	FORWARD VOLTAGE (V)			FORWARD CURRENT (mA)			MIN BRIGHTNESS (cd/m ²) *
		Min	Typ.	Max	Min	Typ.	Max	
1.	Yellow Green	-	3.3	-	-	120	160	40
2.	White	-	4.0	-	-	120	150	500
4.	Amber	-	3.3	-	-	120	160	160

- *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 = 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

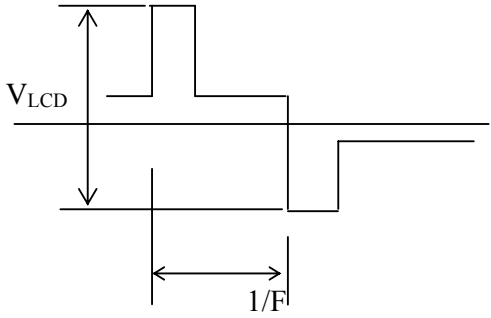
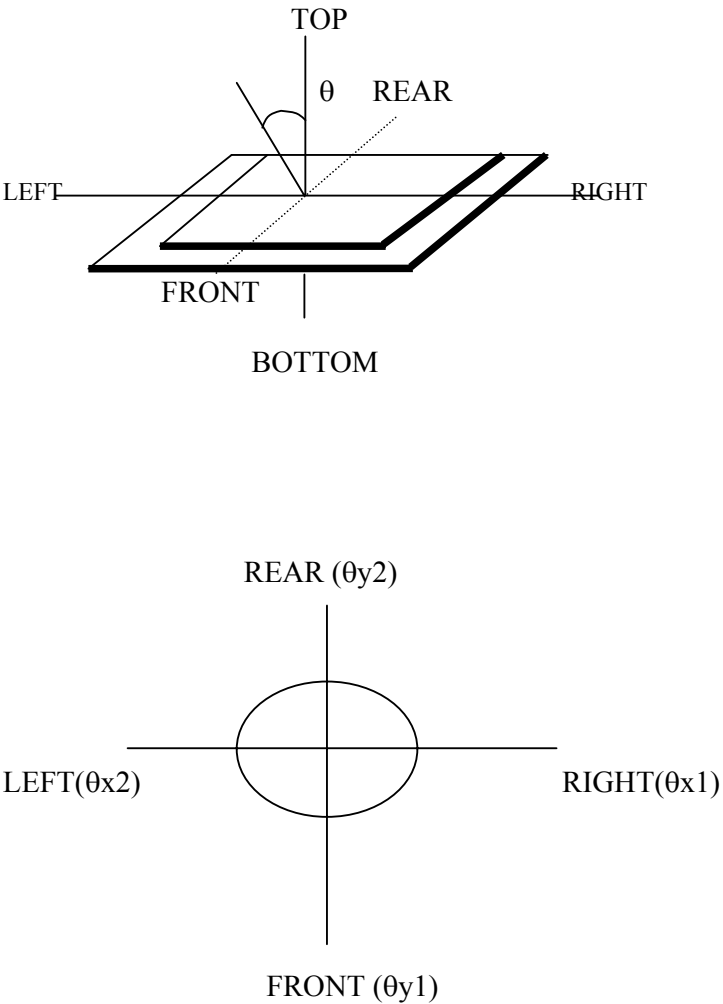
7.1 Electro-optical characteristics (at ambient temperature = 25°C)

NO	ITEM	SYMBOL	CONDITION	LCD TYPE						REF.
				STN YG	STN GREY	STN -VE BLUE	FSTN +VE B/W	FSTN -VE BLUE	FSTN -VE TRUE B/W	
1	Operating Voltage (Volt)	V_{LCD}	$\theta = 0$ $Cr = \max$	14.5 ± 5%						7.1.1
2	Viewing Angle (Deg)	$\theta x 1$	$CR \geq 2$ $V_{LCD} = 4.5V$	+20	+15	+35	+20	+35	+25	7.1.2
		$\theta x 2$		-20	-15	-35	-20	-35	-35	
		$\theta y 1$		-25	-20	-30	-25	-30	-30	
		$\theta y 2$		+25	+20	+30	+25	+30	+30	
3	Contrast Ratio	CR	$\theta = 0^0$ $V_{LCD} = 4.5V$	2.0	1.5	5.0	2.0	5.0	10	7.1.3
4	Response Time (msec)	Rise Time (Tr)	$\theta = 0^0$	550						7.1.4
		Decay Time (Td)	$\theta = 0^0$	400						

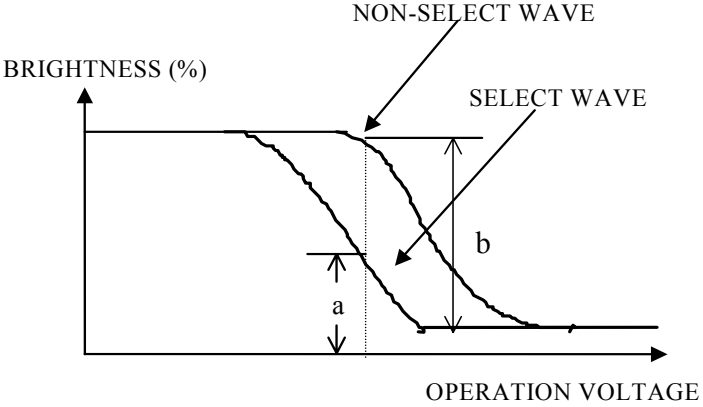
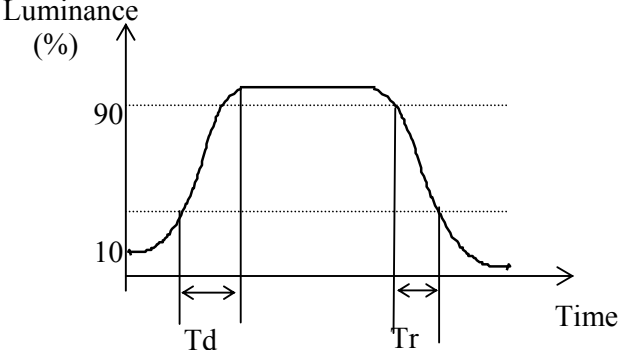
Note:

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	Definition of Operating Voltage (V_{LCD})	 <p>V_{LCD} : Operating Voltage F : Frame Frequency</p>
7.1.2	Definition of Viewing Angle	 <p>Diagram illustrating the viewing angle θ relative to the TOP, REAR, LEFT, RIGHT, FRONT, and BOTTOM directions.</p> <p>Diagram illustrating the viewing angles θ_{x1}, θ_{x2}, θ_{y1}, and θ_{y2} relative to the FRONT, REAR, LEFT, and RIGHT directions.</p>



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

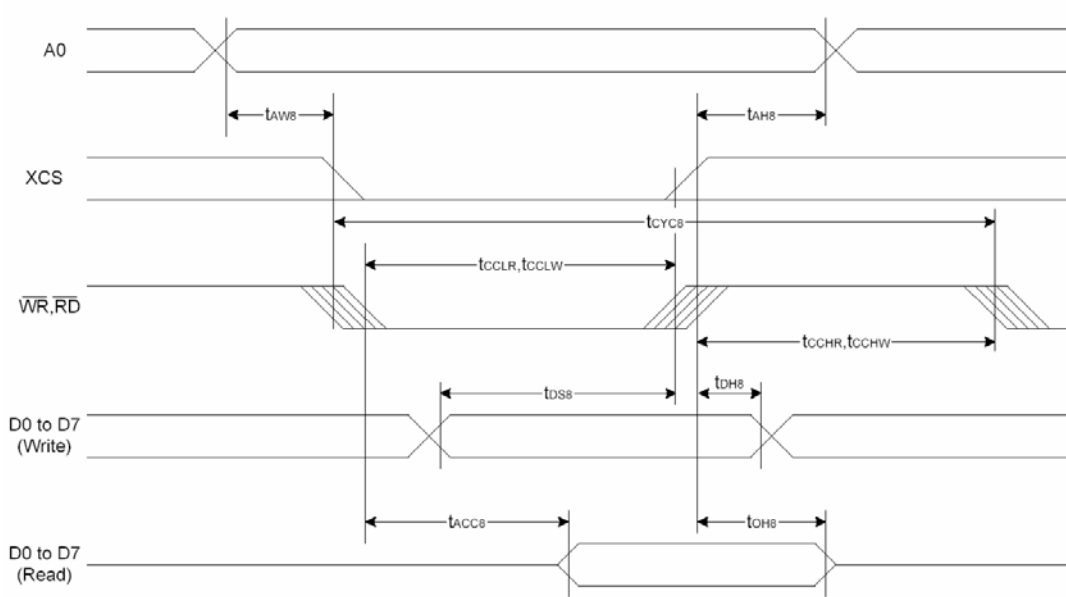


8.0 Interface

8.1	<i>Display Driver/Controller</i>	ST7529	
8.2	<i>Duty Cycle</i>	1/160	
8.3	<i>Pin-out Assignments</i>		
	Pin No	Symbol	Description
	1	X1	Touch Panel (N.C. for non-touch panel model)
	2	Y1	Touch Panel (N.C. for non-touch panel model)
	3	X2	Touch Panel (N.C. for non-touch panel model)
	4	Y2	Touch Panel (N.C. for non-touch panel model)
	5	A	Postive Terminal of Backlight
	6	K	Negative Terminal of Backlight
	7	V _{SS}	Ground Terminal of Module
	8	V _{DD}	Supply Terminal of Module
	9	A0	Register Select
	10	WR	Write Signal
	11 ~ 18	D0 ~ D7	Serial Data
	19	RD	Read Signal
	20	RST	Reset
	21	XCS	Chip Select
	22	C7P	Boosting Capacitor
	23	C1N	Boosting Capacitor
	24	C5P	Boosting Capacitor
	25	C3P	Boosting Capacitor
	26	C1N	Boosting Capacitor
	27	C1P	Boosting Capacitor
	28	C2P	Boosting Capacitor
	29	C2N	Boosting Capacitor
	30	C4P	Boosting Capacitor
	31	C2N	Boosting Capacitor
	32	C6P	Boosting Capacitor
	33	V _{LCDIN}	Boosted Voltage
	34	V _{LCDOUT}	Boosted Voltage
	35	V4	LCD Driver Supply Voltage
	36	V3	LCD Driver Supply Voltage
	37	V2	LCD Driver Supply Voltage
	38	V1	LCD Driver Supply Voltage
	39	V _{0OUT}	Voltage for LCD
	40	V _{0IN}	Voltage for LCD



9.2 For 8080-Series



(VDD = 3.3V , Ta = -30 to 85°C ,Die)

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 Data hold time		tDH8	-	20	-	
READ access time		tACC8	CL = 100 pF	-	40	
READ Output disable time		tOH8	CL = 100 pF	-	30	



9.3 Reset Timing

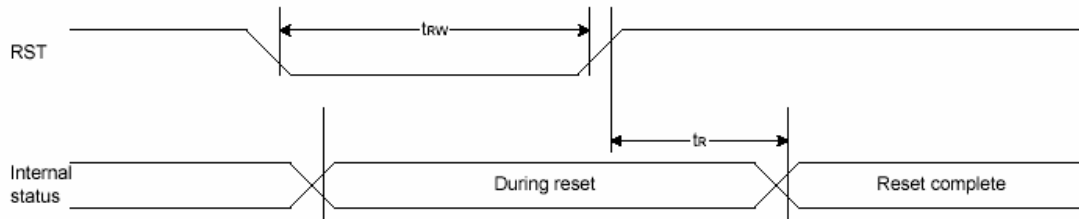


Fig 43.

(VDD = 3.3V , Ta = -30 to 85°C, Die)

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		tR	-	-	-	1	us
Reset "L" pulse width	RST	tRW	-	1	-	-	us

(VDD = 2.7V , Ta = -30 to 85°C, Die)

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		tR	-	-	-	1.5	us
Reset "L" pulse width	RST	tRW	-	1.5	-	-	us



10.0 Memory Map

Memory Map (2B3P, 8-bit mode)

			Column									
LCD read direction	CI = 0		0			1			84			
	CI = 1		84			83			0			
	Pixel		P0	P1	P2	P3	P4	P5	P252	P253	P254	
	Data Line											
			D7' _{1,0}	D2' _{1,0}	D4' _{2,0}	D7' _{1,1}	D2' _{1,1}	D4' _{2,1}	D7' _{1,84}	D2' _{1,84}	D4' _{2,84}	
			D6' _{1,0}	D1' _{1,0}	D3' _{2,0}	D6' _{1,1}	D1' _{1,1}	D3' _{2,1}	D6' _{1,84}	D1' _{1,84}	D3' _{2,84}	
			D5' _{1,0}	D0' _{1,0}	D2' _{2,0}	D5' _{1,1}	D0' _{1,1}	D2' _{2,1}	D5' _{1,84}	D0' _{1,84}	D2' _{2,84}	
			D4' _{1,0}	D7' _{2,0}	D1' _{2,0}	D4' _{1,1}	D7' _{2,1}	D1' _{2,1}	D4' _{1,84}	D7' _{2,84}	D1' _{2,84}	
			D3' _{1,0}	D6' _{2,0}	D0' _{2,0}	D3' _{1,1}	D6' _{2,1}	D0' _{2,1}	D3' _{1,84}	D6' _{2,84}	D0' _{2,84}	
Block	LI = 0	LI = 1										
0	0	159										
	1	158										
	2	157										
	3	156										
1	4	155										
	5	154										
	6	153										
	7	152										
2	8	151										
	9	150										
38	152	7										
	153	6										
	154	5										
	155	4										
39	156	3										
	157	2										
	158	1										
	159	0										
SEGout			0	1	2	3	4	5		252	253	254



Memory Map (3B3PD1 / 3B3PD2, 8-bit mode)

LCD read direction	CI = 0		Column						84		
	CI = 1		0			1			0		
	Pixel		P0	P1	P2	P3	P4	P5	P252	P253	P254
	Data Line		D7' _{1,0}	D7' _{2,0}	D7' _{3,0}	D7' _{1,1}	D7' _{2,1}	D7' _{3,1}	D7' _{1,84}	D7' _{2,84}	D7' _{3,84}
			D6' _{1,0}	D6' _{2,0}	D6' _{3,0}	D6' _{1,1}	D6' _{2,1}	D6' _{3,1}	D6' _{1,84}	D6' _{2,84}	D6' _{3,84}
			D5' _{1,0}	D5' _{2,0}	D5' _{3,0}	D5' _{1,1}	D5' _{2,1}	D5' _{3,1}	D5' _{1,84}	D5' _{2,84}	D5' _{3,84}
			D4' _{1,0}	D4' _{2,0}	D4' _{3,0}	D4' _{1,1}	D4' _{2,1}	D4' _{3,1}	D4' _{1,84}	D4' _{2,84}	D4' _{3,84}
			D3' _{1,0}	D3' _{2,0}	D3' _{3,0}	D3' _{1,1}	D3' _{2,1}	D3' _{3,1}	D3' _{1,84}	D3' _{2,84}	D3' _{3,84}
Block	LI = 0	LI = 1									
0	0	159									
	1	158									
	2	157									
	3	156									
1	4	155									
	5	154									
	6	153									
	7	152									
2	8	151									
	9	150									
38	152	7									
	153	6									
	154	5									
	155	4									
39	156	3									
	157	2									
	158	1									
	159	0									
SEGout			0	1	2	3	4	5	252	253	254

11. Command Summary

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

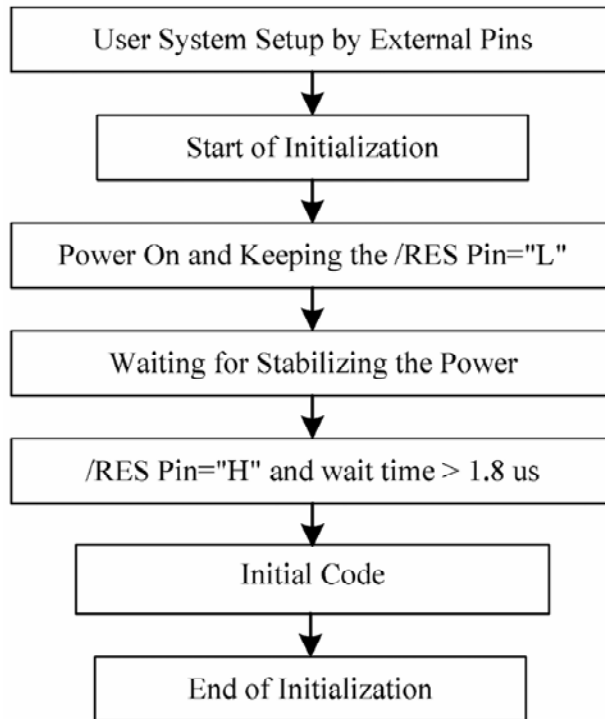


Ext=1

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	Wt. Set	0	1	0	0	0	1	0	0	0	1	0	Weight Set	22	3 bytes
4	ANASET	0	1	0	0	0	1	1	0	0	1	0	Analog Circuit Set	32	3 bytes
5	DITHOFF	0	1	0	0	0	1	1	0	1	0	0	Dithering Circuit Off	34	None
6	DITHON	0	1	0	0	0	1	1	0	1	0	1	Dithering Circuit On	35	None
7	EPCTIN	0	1	0	1	1	0	0	1	1	0	1	Control EEPROM	CD	1 byte
8	EPCOUT	0	1	0	1	1	0	0	1	1	0	0	Cancel EEPROM	CC	None
9	EPMWR	0	1	0	1	1	1	1	1	1	0	0	Write to EEPROM	FC	None
10	EPMRD	0	1	0	1	1	1	1	1	1	0	1	Read from EEPROM	FD	None

12.0 Initialization

12.1 Initialization with Built-in Power Supply Circuits





12.2 Initialization Code

void ST7529_Init(void)

```

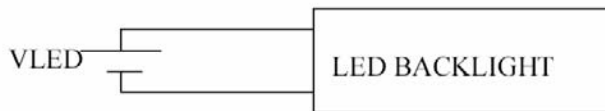
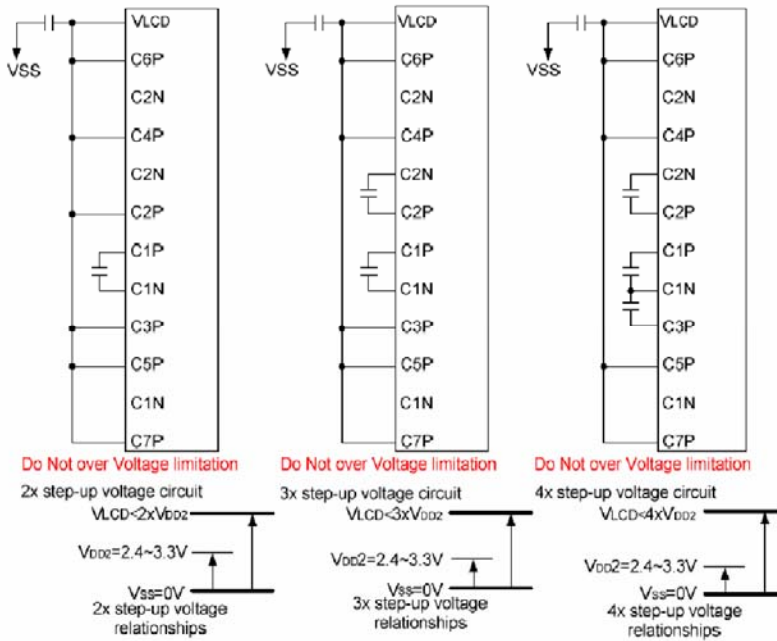
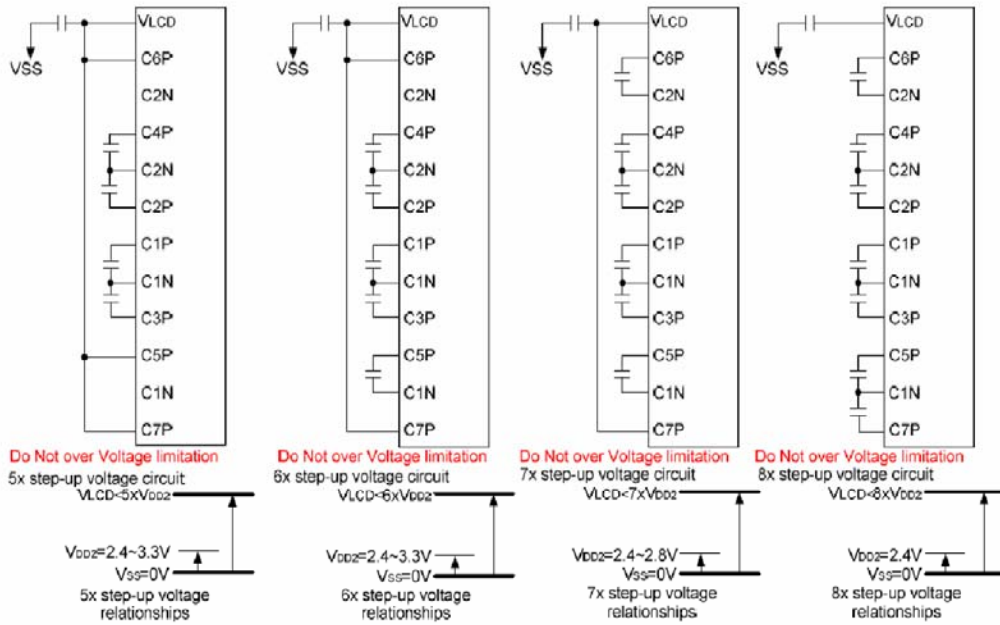
{

```

Write(COMMAND, 0x0030);	//Ext = 0
Write(COMMAND, 0x0094);	//Sleep Out
Write(COMMAND, 0x00D1);	//OSC On
Write(COMMAND, 0x0020);	//Power Control Set
Write(DATA, 0x0008);	//Booster Must Be On First
Delay(1ms);	
Write(COMMAND, 0x0020);	//Power Control Set
Write(DATA, 0x000B);	//Booster, Regulator, Follower ON
Write(COMMAND, 0x0081);	//Electronic Control
Write(DATA, 0x0004);	//Vop=14.0V
Write(DATA, 0x0004);	
Write(COMMAND, 0x00CA);	//Display Control
Write(DATA, 0x0000);	//CL=X1
Write(DATA, 0x0027);	//Duty=160
Write(DATA, 0x0000);	//FR Inverse-Set Value
Write(COMMAND, 0x00A6);	// Normal Display
Write(COMMAND, 0x00BB);	//COM Scan Direction
Write(DATA, 0x0001);	// 0 → 79 159 → 80
Write(COMMAND, 0x00BC);	//Data Scan Direction
Write(DATA, 0x0000);	//Normal
Write(DATA, 0x0000);	//RGB Arrangement
Write(DATA, 0x0001);	//65K COLOR
Write(COMMAND, 0x0075);	//Line Address Set
Write(DATA, 0x0000);	//Start Line=0
Write(DATA, 0x009F);	//End Line =159
Write(COMMAND, 0x0015);	//Column Address Set
Write(DATA, 0x0000);	//Start Column=0
Write(DATA, 0x0054);	//End Column =84
Write(COMMAND, 0x0031);	//Ext = 1
Write(COMMAND, 0x0032);	//Analog Circuit Set
Write(DATA, 0x0000);	//OSC Frequency =000 (Default)
Write(DATA, 0x0001);	//Booster Efficiency=01(Default)
Write(DATA, 0x0000);	//Bias=1/14
Write(COMMAND, 0x0034);	//Dithering Off
ReadEEPROM();	//Read EEPROM Flow
Write(COMMAND, 0x00AF);	//Display On



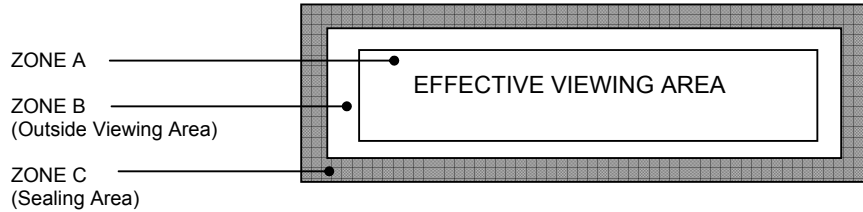
13.0 Power Supply





14.0 Quality Assurance

14.1 ZONE DEFINITION



14.2 REJECTION CRITERIA

14.2.1 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

14.2.2 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 $\geq 30\%$ of the contact ledge width.	<p>The diagram shows a 3D perspective of a glass panel with a fracture along its edge. A double-headed arrow indicates the width of the fracture, labeled as $\leq 30\%$ of the ledge width. Another arrow points to the depth of the fracture, labeled as 'Fracture does not penetrate through the whole glass thickness'.</p>



Defect Category	Defect Description	Criterion	Drawing Specification
Chip	Chip in crossover area	<p>1) Reject - if the chip causes crossover dot to be exposed</p> <p>2) Chip on outside edge of the glass plate but is greater than 50% of glass thickness at crossover dot is reject able.</p>	
Chip	Chip in contact pad area	Accept if:- a) $X \leq 2.0\text{mm}$ b) $Y \leq 0.5\text{mm}$ c) Z disregard	
	Chip in non-contact pad area	Accept if:- a) $X \leq 6.0\text{mm}$ b) $Y \leq 1.0\text{mm}$ c) Z disregard	
	Chip in perimeter seal area	Accept if:- a) $Y \leq 1/3$ of perimeter seal width (W) b) $X \leq 3.0\text{mm}$ c) Z disregard d) X and Y not touch crossover dot	
Corner Chip	Corner chip within seal area	Accept if:- a) $X \leq 1/3$ of perimeter seal width (W) b) $Y \leq 1/3$ 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) $XY \leq 4\text{mm}^2$ AND b) $Y \leq D$ and $X \leq 2.0\text{mm}$ c) Z disregard	
	Corner chip effecting contact pad / ITO	A) Accept if:- a) $XY \leq 4\text{mm}^2$ AND b) $Y \leq D$ and $X \leq 2.0\text{mm}$ B) Accept if:- a) $X1 \leq 2.0\text{mm}$ b) $Y1 \leq 0.5\text{mm}$ Z disregard	
Glass flare	A thin layer of glass flare at contact area	Accept if:- a) Flare thickness $\leq \frac{1}{4}W$ when $W \leq 3\text{mm}$ b) Flare thickness $\leq 1\text{mm}$ when $W > 3\text{mm}$ 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)	

14.2.3 POLARIZER DEFECTS

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 border 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	



Defect Category	Defect Description	Criterion	Drawing Specification																				
	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																					
	Polarizer bubble / Foreign material	<table border="1"> <thead> <tr> <th rowspan="2">Zone / Dimension</th> <th colspan="3">Acceptable No.</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$D \leq 0.30\text{mm}$</td> <td>NC</td> <td>NC</td> <td rowspan="4">NC if the Polarizer not lifted up/ peel off</td> </tr> <tr> <td>$D \leq 0.50\text{mm}$</td> <td>2</td> <td>NC</td> </tr> <tr> <td>$0.50 < D \leq 0.60\text{mm}$</td> <td>1</td> <td>2</td> </tr> <tr> <td>$D > 0.60\text{mm}$</td> <td>0</td> <td>0</td> </tr> </tbody> </table> <p>NC: No count D: Mean Diameter of Defect</p> <p>3 are the totally permissible numbers of bubble</p>	Zone / Dimension	Acceptable No.			A	B	C	$D \leq 0.30\text{mm}$	NC	NC	NC if the Polarizer not lifted up/ peel off	$D \leq 0.50\text{mm}$	2	NC	$0.50 < D \leq 0.60\text{mm}$	1	2	$D > 0.60\text{mm}$	0	0	<p>$D = (A + B)/2$</p>
Zone / Dimension	Acceptable No.																						
	A	B	C																				
$D \leq 0.30\text{mm}$	NC	NC	NC if the Polarizer not lifted up/ peel off																				
$D \leq 0.50\text{mm}$	2	NC																					
$0.50 < D \leq 0.60\text{mm}$	1	2																					
$D > 0.60\text{mm}$	0	0																					

14.2.4 ELECTRICAL TEST DEFECTS

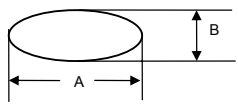
Defect Category	Defect Description	Criterion	Drawing Specification
Missing common	Part of the pattern does not light up	Reject	
Missing segment	One or few segment does not light up	Reject	
Common-common short	Common and common connected	Reject	
Segment-segment short	Segment and segment connected	Reject	
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 $\leq 0.20\text{mm}$ (mean diameter)	
Slow response	Response of the display on one side slower than the other side	Reject if it is visible at 30cm distance	



Defect Category	Defect Description	Criterion		Drawing Specification
Pin Hole	Pin hole / void at light up segment	Zone / Dimension	Acceptable No.	
		Located inside single pixel/dot:- $(X + Y)/2 \leq 0.20\text{mm}$	- 1 per pixel/dot - 3 per display (Active Area)	
		Laid over the plural pixel/dots: $(X + Y)/2 \leq 0.20\text{mm}$	- 1 per pixel/dot - 3 per display (Active Area)	
		<i>(3/4 or larger part of dot area has to be effective for display)</i>		
Deformed display dot	Lacked deformation	Accept if: i) $X \leq 0.15$ and ii) $Y \leq 0.15$		
	Added deformation	Accept if: i) $X < 0.02$ and ii) $Y < 0.02$		
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		
Segment Smearing	Light up segment smear	Reject		
Dim segment	Display shows poor contrast at pre set voltage	Reject		

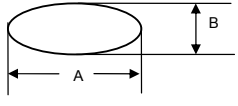


14.2.5 BLACK SPOT, WHITE SPOT AND FOREIGN MATERIAL (SOLID FIGURE)

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.			 $D = (A + B)/2$	
		$D \leq 0.10\text{mm}$	NC	NC	NC		
		$0.10 < D \leq 0.15\text{mm}$	3	3	NC		
		$0.15 < D \leq 0.25\text{mm}$	1	2	NC		
		$0.25 < D \leq 0.35\text{mm}$	1	1	NC		
		$D > 0.35 \text{ mm}$	0	0	NC		
		NC: No count					
		D: Mean Diameter of Defect					

NOTE: The 1/3 or larger parts of individual dot has to be lighted on.
 The solid figure is that the defect has clear-cut outline at the optimum driving condition in both positive and negative, of which size does not change when the contrast changes.

14.2.6 BLACK SPOT, WHITE SPOT AND FOREIGN MATERIAL (FADED FIGURE)

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.			 $D = (A + B)/2$
		$D \leq 0.60\text{mm}$	NC	NC	NC	
		$0.60 < D \leq 0.70\text{mm}$	3		NC	
		$0.70 < D \leq 0.80\text{mm}$	1	NC		
		$D > 0.80 \text{ mm}$	0		NC	
		NC: No count				
D: Mean Diameter of Defect						

NOTE: Faded figure means that the defects has unclear outline at the optimum driving condition in both positive and negative, of which size seems to change when the contrast changes.



14.2.7 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	
		NC	\leq 0.03mm	NC	NC	NC	
		\leq 2 mm	\leq 0.05mm	1	1	NC	
		\leq 1 mm	\leq 0.10mm	1	2	NC	
		NC	\geq 0.10mm	Due to (1) round defect			

NOTE: Length is X and Width is Y.

REMARK:

i) Total amount of spot defects including round and linear – A total of 5 permissible numbers of defects in Zone A & B including above (14.2.5), (14.2.6), (14.2.7). Regardless of number of defects, the minimum distance between individual defects have to be 5mm or larger.

ii) All the other items of inspection that are not included herein must be determined by the “Limit Standard” sample, which were occasionally set up with the mutual consent of both parties. In every case of the items set up with the Limit Standard, the Limit Standard always takes precedence over the other means of definition.



15. 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

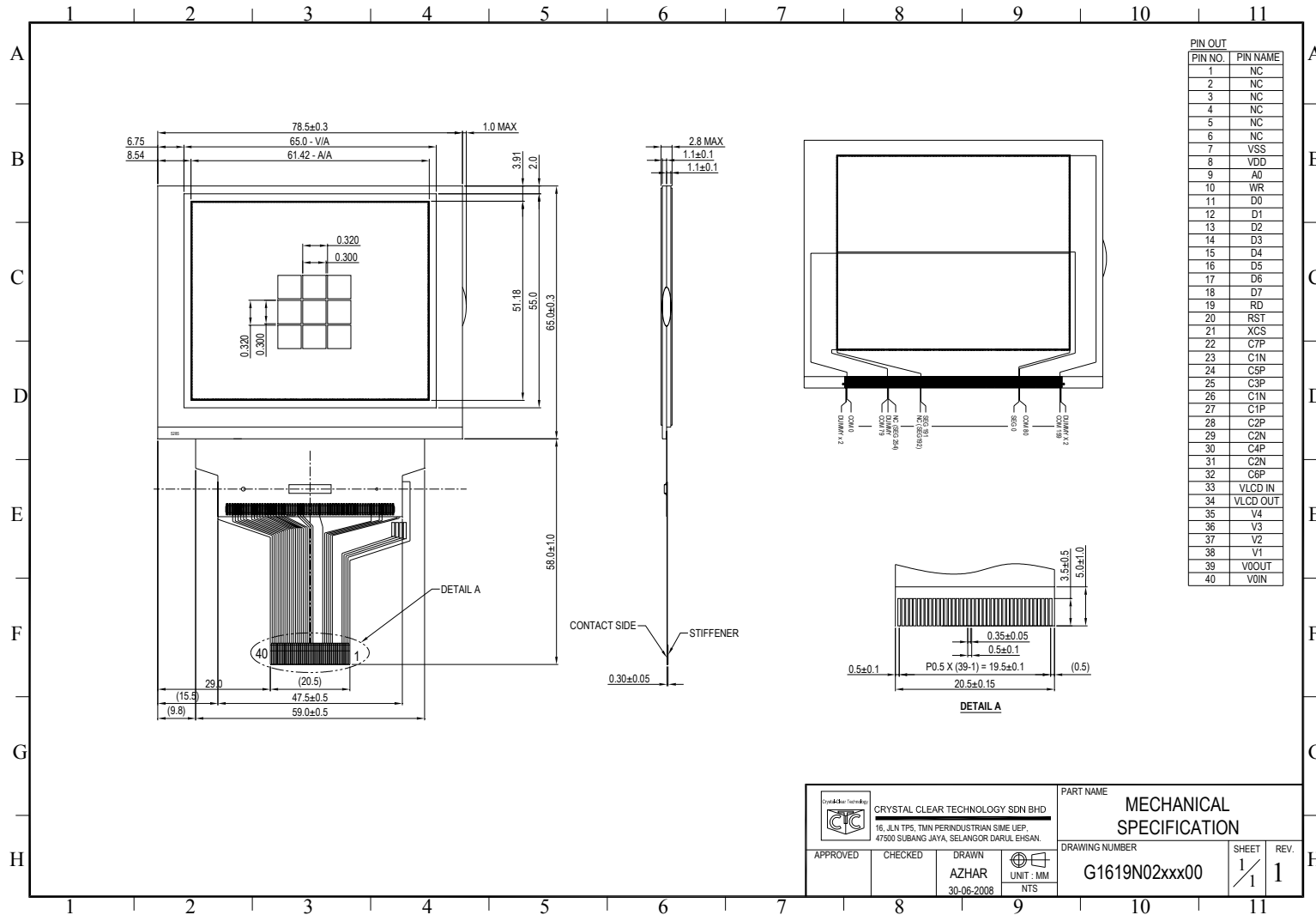
If any fluid leaks out of the damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

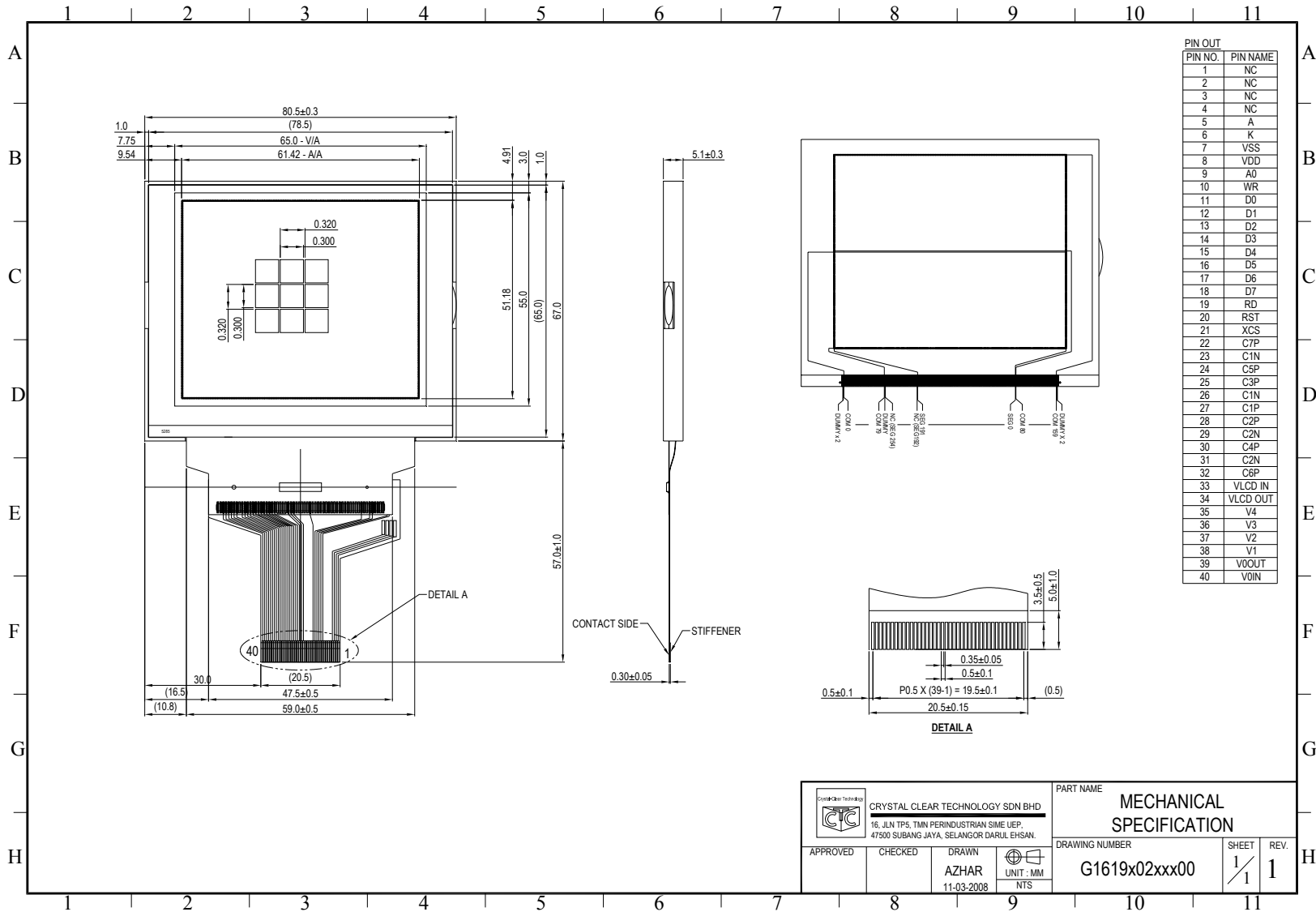
2.6 Limited Warranty

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.



16. Drawing





CRYSTAL CLEAR TECHNOLOGY SDN BHD 16, JLN TPN, TMN PERINDUSTRIAN SIME UEP, 47500 SUBANG JAYA, SELANGOR DARUL EHSAN.			PART NAME MECHANICAL SPECIFICATION			
APPROVED	CHECKED	DRAWN	UNIT : MM NTS	DRAWING NUMBER	SHEET	REV.
		AZHAR 11-03-2008		G1619x02xxx00	1/1	1



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