Crystal Clear Technology

Product Specification

G64128X19 series

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1.0 Table of Contents

2.0 Record of revision

Rev	Date	Item	Page	Comment	Originator	Checked By
1.0	12/09/08			Initial Release	Syam	Azhar
2.0	10/10/08	5.1	4	Update in supply voltage of white and blue backlight from 5.0 to 4.1V.	Syam	Azhar
3.0	17/10/08	12.0	17	Update of QA specification	Syam	Azhar
4.0	29/10/08	8.1	8	Pin out description error	Syam	Azhar

3.0 General specification

Display format: Graphics 128 (w) x 64 (h) dots

Dot size: 0.20 (w) x 0.20 (h) mm

Dot pitch: 0.22 (w) x 0.22 (h) mm

View area: 32.0 (w) x 17.8 (h) mm

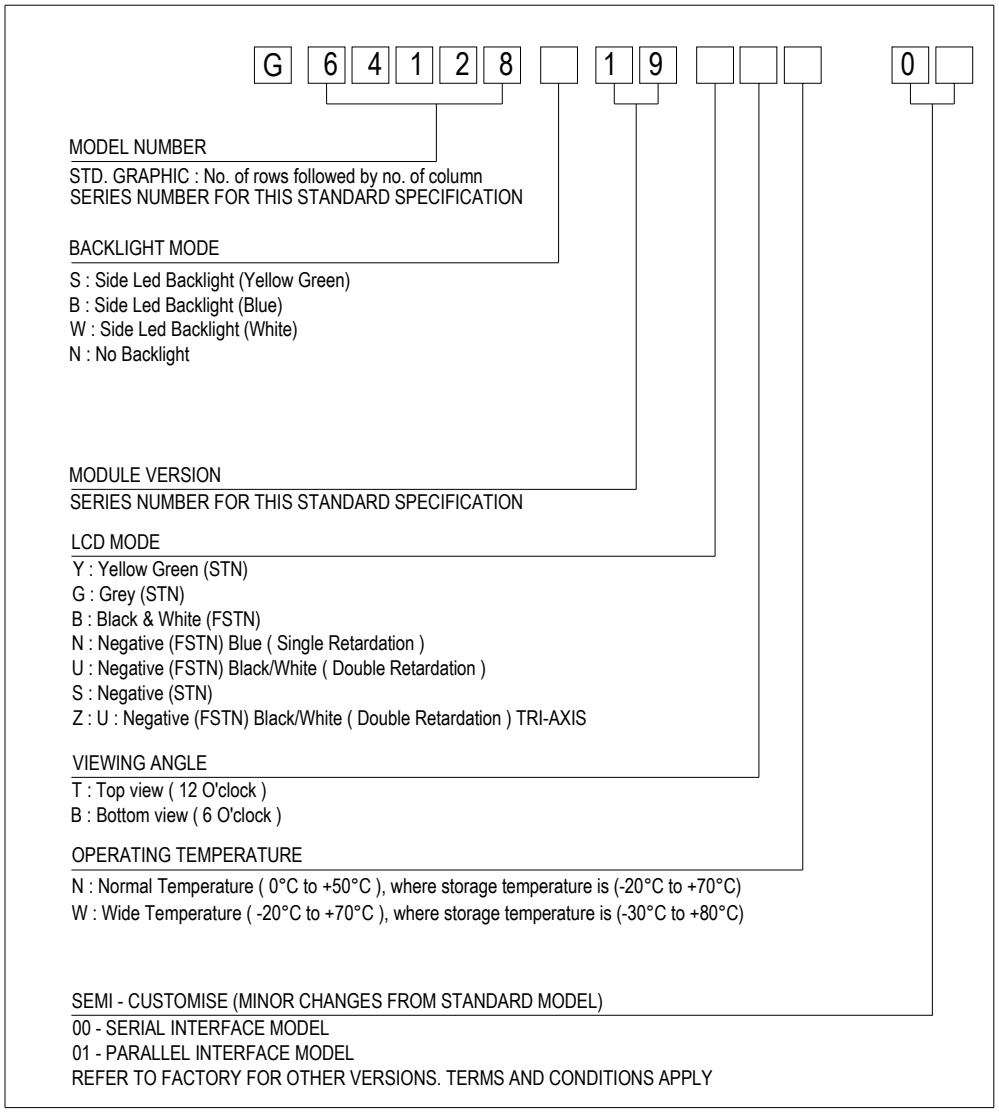
Active area: 28.14 (w) x 14.06 (h) mm

General dimensions: 36.20 (w) x 28.45 (h) x 4.15 (t) mm

Controller/Driver: NT7534 or equivalent

Interface: Parallel/Serial

Driving method: 1/64 duty, 1/9 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}	-0.3	4.0	V
2.	Operating Temperature	T_{op}	Refer page 3		°C
3.	Storage Temperature	T_{st}	Refer page 3		°C

5.0 Electrical characteristics

NO	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
1.	Operating Voltage	V_{DD}	-	-	3.3	-	V
2.	Power Supply voltage	V_{LCD}	25°C	8.4±5%			V
3.	Current Supply	I_{DD}	V_{DD} = 3.3V 4x Boosting	-	120	400	uA

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	30
2.	White	-	4.1	-	-	30	40	100
3.	Blue	-	4.1	-	-	60	80	100

*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. 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	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.

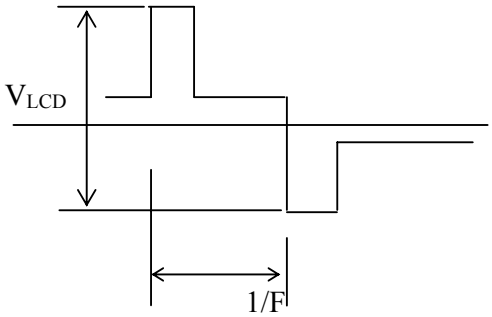
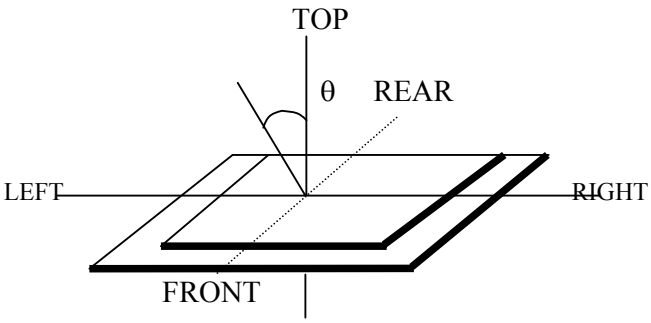
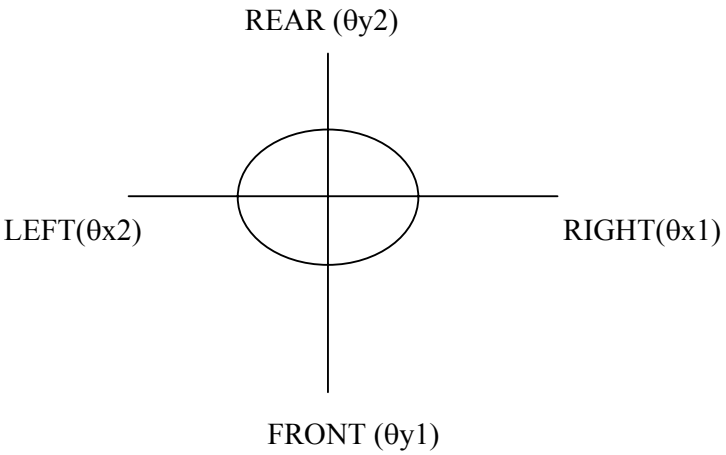
7.0 LCD specification

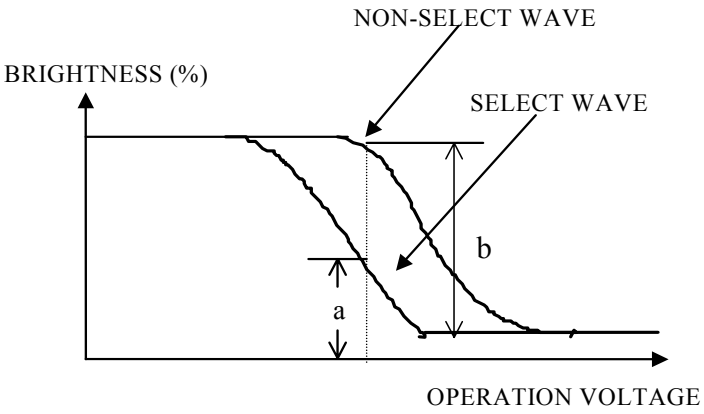
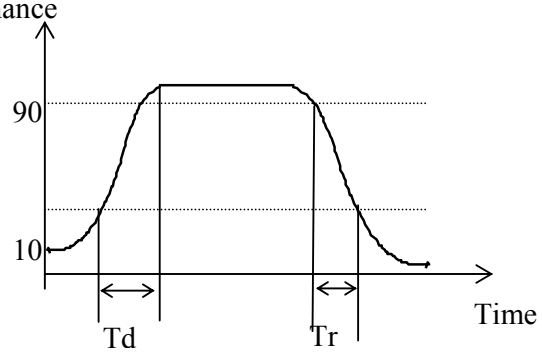
7.1 Electro-optical characteristics (at ambient temperature = 25°C)

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	FSTN -VE TRI AXIS	
1	Operating Voltage (Volt)	V_{LCD}	θ = 0 Cr = max	8.4 ± 5%							7.1.1
2	Viewing Angle (Deg)	θ x 1	CR ≥ 2 V_{LCD} = 14.7V	+25	+20	+35	+25	+35	+35	+40	7.1.2
		θ x 2		-25	-20	-35	-25	-35	-40	-40	
		θ y 1		-30	-25	-35	-30	-35	-35	-50	
		θ y 2		+30	+25	+35	+30	+35	+35	+30	
3	Contrast Ratio	CR	$\theta = 0^0$ V_{LCD} =14.7V	3.0	2.3	6.0	3.0	6.0	20	20	7.1.3
4	Response Time (msec)	Rise Time (Tr)	$\theta = 0^0$	200							7.1.4
		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} : 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 Serial Interface (G64128x19xxx00 model)

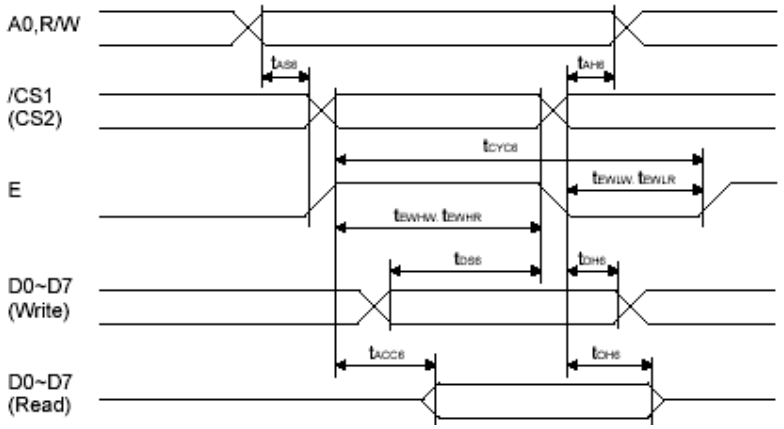
Display Driver	NT7534 OR EQUIVALENT	
Pin No	**Symbol**	**Description**
1	CS1	Data/Instruction input pin
2	RESB	Reset input pin
3	RS	Register select input pin
4	SCLK	Serial input clock
5	SID	Serial input data
6	VDD	Power supply
7	VSS	Ground
8	VOUT	Voltage converter 1/O pin
9	C3+	Positive connection for capacitor 3
10	C1-	Negative connection for capacitor 1
11	C1+	Positive connection for capacitor 1
12	C2+	Positive connection for capacitor 2
13	C2-	Negative connection for capacitor 2
14	V1	Driving Supply Voltage
15	V2	Driving Supply Voltage
16	V3	Driving Supply Voltage
17	V4	Driving Supply Voltage
18	VO	Driving Supply Voltage

8.2 Parallel Interface (G64128x19xxx01 model)

Display Driver	NT7534 OR EQUIVALENT	
Pin No	**Symbol**	**Description**
1	/CS	Chip select input pins
2	/RES	Reset input pin
3	RS	Register select input pin
4	R/W(/WR)	Read/Write execution control pin
5	E(/RD)	Read/Write execution control pin
6	D0	8 bit bi-directional data bus
7	D1	8 bit bi-directional data bus
8	D2	8 bit bi-directional data bus
9	D3	8 bit bi-directional data bus
10	D4	8 bit bi-directional data bus
11	D5	8 bit bi-directional data bus
12	D6	8 bit bi-directional data bus
13	D7	8 bit bi-directional data bus
14	VDD	Power Supply
15	VSS	Ground
16	VOUT	Voltage converter I/O pin
17	C4+	Positive connection for capacitor 4
18	C3+	Positive connection for capacitor 3
19	C1-	Negative connection for capacitor 1
20	C1+	Positive connection for capacitor 1
21	C2+	Positive connection for capacitor 2
22	C2-	Negative connection for capacitor 2
23	V1	Driving supply voltage
24	V2	Driving supply voltage
25	V3	Driving supply voltage
26	V4	Driving supply voltage
27	V0	Driving supply voltage
28	P/S	Parallel/Serial data input select pin

9.0 Functional Descriptions

9.1 Read/Write timing characteristics



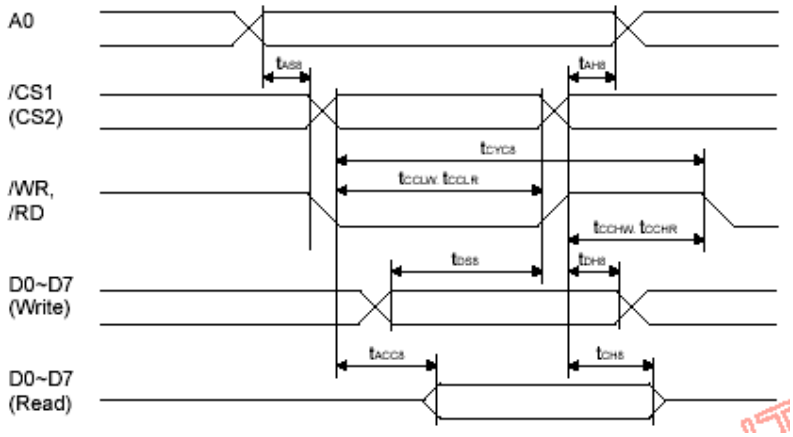
(VDD = 2.7 ~ 3.6V, Ta = -40 ~ +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{AH6}	Address hold time	0	-	-	ns	A0, R/W
t_{AS6}	Address setup time	0	-	-	ns	
t_{CYC6}	System cycle time	240	-	-	ns	
t_{EWHW}	Control high pulse width (write)	90	-	-	ns	E
t_{EWHR}	Control high pulse width (read)	120	-	-	ns	E
t_{EWLW}	Control low pulse width (write)	100	-	-	ns	E
t_{EWLR}	Control low pulse width (read)	60	-	-	ns	E
t_{DS6}	Data setup time	40	-	-	ns	D0~D7
t_{DH6}	Data hold time	10	-	-	ns	
t_{ACC6}	/RD access time	-	-	140	ns	D0~D7 CL = 100pF
t_{OH6}	Output disable time	5	-	50	ns	

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{AH6}	Address hold time	0	-	-	ns	A0, R/W
t_{AS6}	Address setup time	0	-	-	ns	
t_{CYC6}	System cycle time	400	-	-	ns	
t_{EWHW}	Control high pulse width (write)	150	-	-	ns	E
t_{EWHR}	Control high pulse width (read)	150	-	-	ns	E
t_{EWLW}	Control low pulse width (write)	120	-	-	ns	E
t_{EWLR}	Control low pulse width (read)	120	-	-	ns	E
t_{DS6}	Data setup time	80	-	-	ns	D0~D7
t_{DH6}	Data hold time	30	-	-	ns	
t_{ACC6}	/RD access time	-	-	240	ns	D0~D7 CL = 100pF
t_{OH6}	Output disable time	10	-	100	ns	

*1. The input signal rise time and fall time (t_r, t_f) is specified at 15ns or less.
($t_r + t_f$) < (t_{CYC6} - t_{EWLW} - t_{EWHW}) for write, ($t_r + t_f$) < (t_{CYC6} - t_{EWLR} - t_{EWHR}) for read.
*2. All timing is specified using 20% and 80% of VDD as the reference.
*3. t_{EWHW} and t_{EWHR} are specified as the overlap interval when /CS1 is low (CS2 is high) and E is high.

Read/Write characteristics (6800 series MPU)



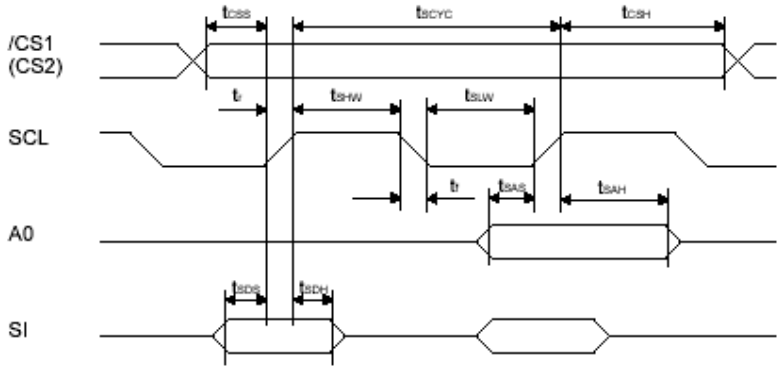
(VDD = 2.7 ~ 3.6V, Ta = -40 ~ +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
T_{AH8}	Address hold time	0	-	-	ns	A0
T_{AS8}	Address setup time	0	-	-	ns	
t_{CYC8}	System cycle time	240	-	-	ns	
t_{CCLW}	Control low pulse width (write)	90	-	-	ns	/WR
t_{CCLR}	Control low pulse width (read)	120	-	-	ns	/RD
t_{CCHW}	Control high pulse width (write)	100	-	-	ns	/WR
t_{CCHR}	Control high pulse width (read)	60	-	-	ns	/RD
T_{DS8}	Data setup time	40	-	-	ns	D0~D7
T_{DH8}	Data hold time	10	-	-	ns	
t_{ACC8}	/RD access time	-	-	140	ns	D0~D7, CL = 100pF
T_{CH8}	Output disable time	5	-	50	ns	

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{AH8}	Address hold time	0	-	-	ns	A0
t_{AS8}	Address setup time	0	-	-	ns	
t_{CYC8}	System cycle time	400	-	-	ns	
t_{CCLW}	Control low pulse width (write)	150	-	-	ns	/WR
t_{CCLR}	Control low pulse width (read)	150	-	-	ns	/RD
t_{CCHW}	Control high pulse width (write)	120	-	-	ns	/WR
t_{CCHR}	Control high pulse width (read)	120	-	-	ns	/RD
t_{DS8}	Data setup time	80	-	-	ns	D0~D7
t_{DH8}	Data hold time	30	-	-	ns	
t_{ACC8}	/RD access time	-	-	240	ns	D0~D7, CL = 100pF
t_{CH8}	Output disable time	10	-	100	ns	

*1. The input signal rise time and fall time (t_r, t_f) is specified at 15ns or less.
($t_r + t_f$) < (t_{CYC8} - t_{CCLW} - t_{CCHW}) for write, ($t_r + t_f$) < (t_{CYC8} - t_{CCLR} - t_{CCHR}) for read.
*2. All timing is specified using 20% and 80% of VDD as the reference.
*3. t_{CCLW} and t_{CCLR} are specified as the overlap interval when /CS1 is low (CS2 is high) and /WR or /RD is low.

Read/Write characteristics (8080 series MPU)



(VDD = 2.7 ~ 3.6V, Ta = -40 ~ +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{SCYC}	Serial clock cycle	120	-	-	ns	SCL
t_{SHW}	Serial clock H pulse width	60	-	-	ns	SCL
t_{SLW}	Serial clock L pulse width	60	-	-	ns	SCL
t_{SAS}	Address setup time	30	-	-	ns	A0
t_{SAH}	Address hold time	20	-	-	ns	A0
t_{SDS}	Data setup time	30	-	-	ns	SI
t_{SDH}	Data hold time	20	-	-	ns	SI
t_{CSS}	Chip select setup time	20	-	-	ns	/CS1, CS2
t_{CSH}	Chip select hold time	40	-	-	ns	/CS1, CS2

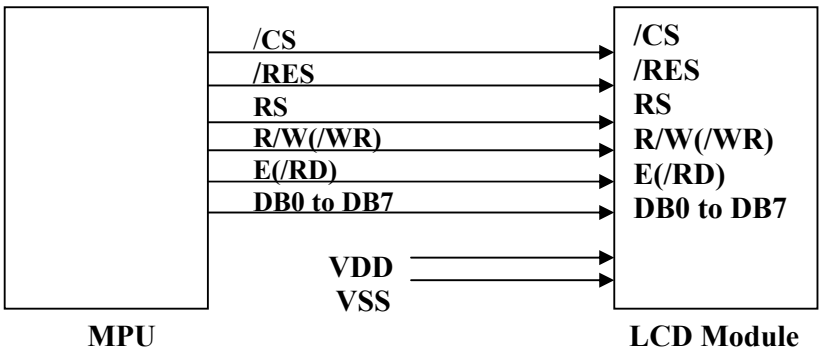
Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{SCYC}	Serial clock cycle	200	-	-	ns	SCL
t_{SHW}	Serial clock H pulse width	80	-	-	ns	SCL
t_{SLW}	Serial clock L pulse width	80	-	-	ns	SCL
t_{SAS}	Address setup time	60	-	-	ns	A0
t_{SAH}	Address hold time	30	-	-	ns	A0
t_{SDS}	Data setup time	60	-	-	ns	SI
t_{SDH}	Data hold time	60	-	-	ns	SI
t_{CSS}	Chip select setup time	40	-	-	ns	/CS1, CS2
t_{CSH}	Chip select hold time	100	-	-	ns	/CS1, CS2

*1. The input signal rise time and fall time (t_r, t_f) is specified as 15ns or less.
*2. All timing is specified using 20% and 80% of VDD as the standard.

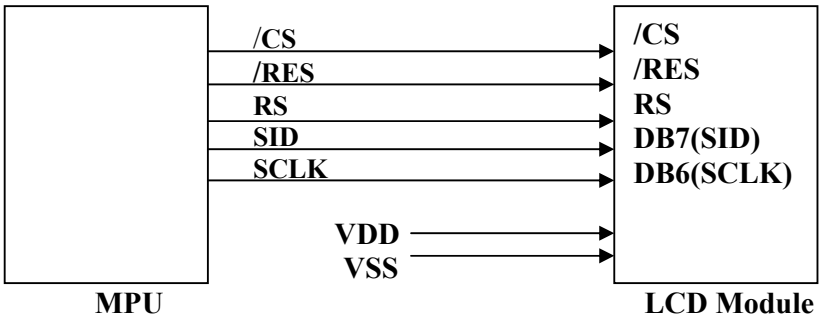
Read/Write characteristics (Serial Interface 4 Wire)

9.2 Application Circuits

9.2.1 6800 (8080) MPU Interface



9.2.2 Serial Interface

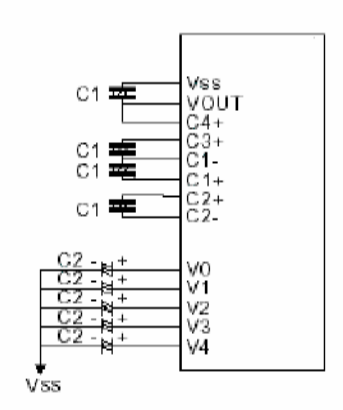


10. Instruction Set

Command	A0	/RD	/WR	Code D7	D6	D5	D4	D3	D2	D1	D0	Hex	Function
(1) Display OFF	0	1	0	1	0	1	0	1	1	1	0 1	AEh AFh	Turn on LCD panel when high, and turn off when low
(2) Display Start Line Set	0	1	0	0	1	Display Start Address						40h to 7Fh	Specifies RAM display line for COM0
(3) Page Address Set	0	1	0	1	0	1	1	Page Address				B0h to B8h	Set the display data RAM page in Page Address register
(4) Column Address Set	0	1	0	0	0	0	1	Higher Column Address				00h to 18h	Set 4 higher bits and 4 lower bits of column address of display data RAM in register
	0	1	0	0	0	0	0	Lower Column Address					
(5) Read Status	0	0	1	Status				0	0	0	0	XX	Reads the status information
(6) Write Display Data	1	1	0	Write Data								XX	Write data in display data RAM
(7) Read Display Data	1	0	1	Read Data								XX	Read data from display data RAM
(8) ADC Select	0	1	0	1	0	1	0	0	0	0	0 1	A0h A1h	Set the display data RAM address SEG output correspondence
(9) Normal/Reverse Display	0	1	0	1	0	1	0	0	1	1	0 1	A6h A7h	Normal indication when low, but full indication when high
(10)Entire Display ON/OFF	0	1	0	1	0	1	0	0	1	0	0 1	A4h A5h	Select normal display (0) or entire display on
(11)LCD Bias Set	0	1	0	1	0	1	0	0	0	1	0 1	A2h A3h	Sets LCD driving voltage bias ratio
(12)Read-Modify-Write	0	1	0	1	1	1	0	0	0	0	0	E0h	Increments column address counter during each write
(13)End	0	1	0	1	1	1	0	1	1	1	0	EEh	Releases the Read-Modify-Write
(14)Reset	0	1	0	1	1	1	0	0	0	1	0	E2h	Resets internal functions
(15)Common Output Mode Select	0	1	0	1	1	0	0	0 1	*	*	*	C0h to CFh	Select COM output scan direction *: invalid data
(16)Power Control Set	0	1	0	0	0	1	0	1	Operation Status			28h to 2Fh	Select the power circuit operation mode
(17)V0 Voltage Regulator Internal Resistor ratio Set	0	1	0	0	0	1	0	0	Resistor Ratio			20h to 27h	Select internal resistor ratio Rb/Ra mode
(18)Electronic Volume mode Set	0	1	0	1	0	0	0	0	0	0	1	81h	
Electronic Volume Register Set	0	1	0	*	*	Electronic Control Value						XX	Sets the V0 output voltage electronic volume register
(19)Set Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0 1	ACh ADh	Sets static indicator ON/OFF 0: OFF, 1: ON
Set Static Indicator Register	0	1	0	*	*	*	*	*	*	Mode		XX	Sets the flash mode
(20)Power Save	0	1	0	-	-	-	-	-	-	-	-	-	Compound command of Display OFF and Entire Display ON
(21)NOP	0	1	0	1	1	1	0	0	0	1	1	E3h	Command for non-operation

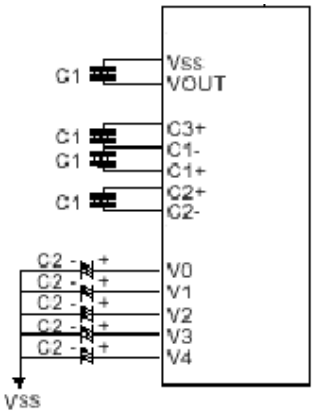
Command	A0	/RD	/WR	Code									Function
				D7	D6	D5	D4	D3	D2	D1	D0	Hex	
(22)Oscillation Frequency Select	0	1	0	1	1	1	0	0	1	0	0 1	E4h E5h	Select the oscillation frequency
(23)Partial Display mode Set	0	1	0	1	0	0	0	0	0	1	0 1	82h 83h	Enter/Release the partial display mode
(24)Partial Display Duty Set	0	1	0	0	0	1	1	0	Duty Ratio			30h 37h	Sets the LCD duty ratio for partial display mode
(25)Partial Display Bias Set	0	1	0	0	0	1	1	1	Bias Ratio			38h 3Fh	Sets the LCD bias ratio for partial display mode
(26)Partial Start Line Set	0	1	0	1	1	0	1	0	0	1	1	D3h	Enter Partial Start Line Set
Partial Start Line Set	0	1	0	1	1	Partial Start Line						XX	Sets the LCD Number of partial display start line
(27)N-Line Inversion Set	0	1	0	1	0	0	0	0	1	0	1	85h	Enter N-Line inversion
Number of Line Set	0	1	0	*	*	*	Number of Line					XX	Sets the number of line used for N-Line inversion
(28)N-Line Inversion Release	0	1	0	1	0	0	0	0	1	0	0	84h	Exit N-Line Inversion
(29)DC/DC Clock Set	0	1	0	1	1	1	0	0	1	1	0	E6h	Set DC/DC Clock Frequency
DC/DC Clock Division Set	0	1	0	1	1	0	0	Clock Division				XX	Set the Division of DC/DC Clock Frequency
(30)Test Command	0	1	0	1	1	1	1	*	*	*	*	F1h to FFh	IC test command. Do not use!
(31)Test Mode Reset	0	1	0	1	1	1	1	0	0	0	0	F0h	Command of test mode reset

11. Power Supply



(C1 = 4.7 uF, C2 = 1uF)

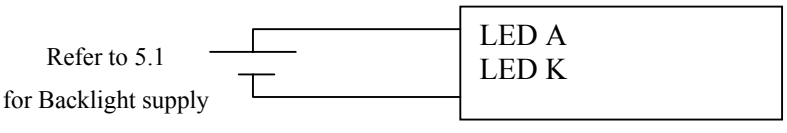
For parallel interface module (G64128x19xxx01)



(C1 = 4.7 uF, C2 = 1uF)

Note: C4+ is internally connected at FPC to Vout. Thus, circuitry is 4x step up.

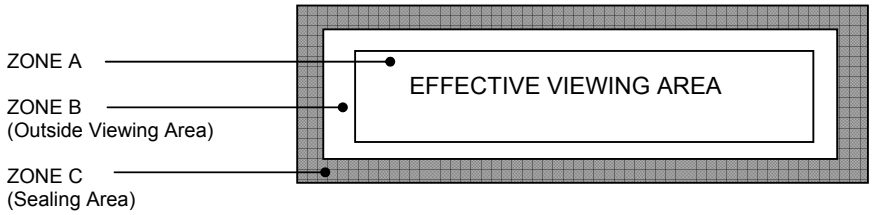
For serial interface module (G64128x19xxx00)



For backlight version only

12.0 Quality Assurance

12.1 ZONE DEFINITION

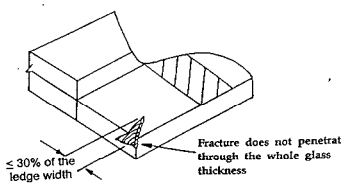


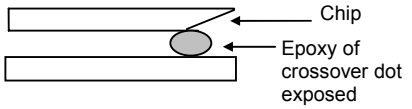
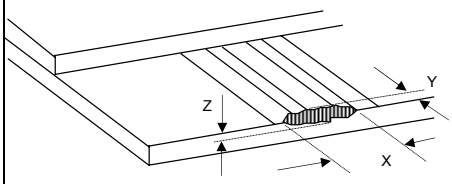
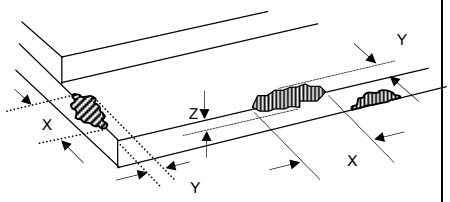
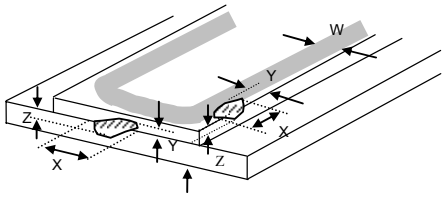
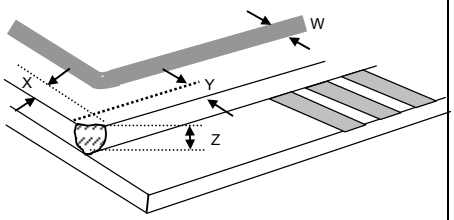
12.2 REJECTION CRITERIA

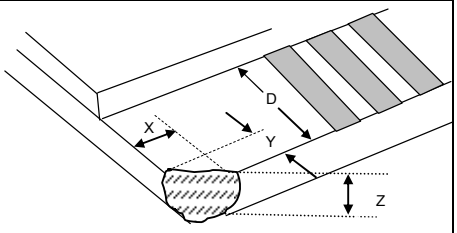
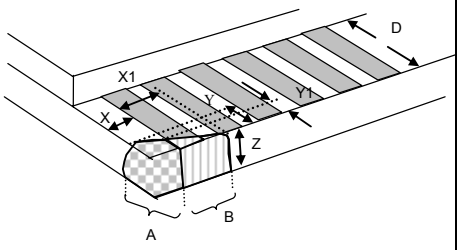
12.2.1 DIMENSIONAL DEFECTS

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

12.2.2 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.	

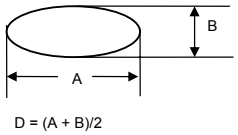
Defect Category	Defect Description	Criterion	Drawing Specification
Chip	Chip in cross over area	1) Reject - if the chip causes crossover dot to be exposed 2) Chip on outside edge of the glass plate but is greater than 50% of glass thickness at crossover dot is reject able.	
Chip	Chip in contact pad area	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)	

12.2.3 POLARIZER DEFECT

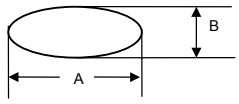
Defect Category	Defect Description	Criterion	Drawing Specification
Polarizer defect	Polarizer coverage	1- Polarizer should cover effective viewing area of display. 2- It is acceptable if perimeter seal bolder at all sides could be seen. 3- It is acceptable if polarizer attaching position meeting the 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">Acceptable No.</td></tr>
<tr><td>Dimension</td><td colspan="3">A</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>

12.2.4 FUNCTIONAL DEFECT

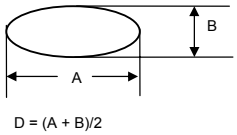
<table>
<tr><th>Defect Category</th><th>Defect Description</th><th>Criterion</th><th>Drawing Specification</th></tr>
<tr><td>Missing common</td><td>Part of the pattern does not light up</td><td>Reject</td><td></td></tr>
<tr><td>Missing segment</td><td>One or few segment does not light up</td><td>Reject</td><td></td></tr>
<tr><td>Common-common short</td><td>Common and common connected</td><td>Reject</td><td></td></tr>
<tr><td>Segment-segment short</td><td>Segment and segment connected</td><td>Reject</td><td></td></tr>
<tr><td>Common – segment short</td><td>Common and segment connected</td><td>Reject</td><td></td></tr>
<tr><td>Wrong viewing angle</td><td>Wrong viewing angle</td><td>Reject if display viewing angle not conform to customer requirement</td><td></td></tr>
<tr><td>Metal residue</td><td>Extra spot lights up at the border of the segment.</td><td>Accept if ≤ 0.20mm (mean diameter)</td><td></td></tr>
<tr><td>Slow response</td><td>Response of the display on one side slower than the other side</td><td>Reject if it is visible at 30cm distance</td><td></td></tr>
<tr><td>Reverse twist/ tilt</td><td>Segment are darker or clearer than other area of the same segment</td><td>Reject</td><td></td></tr>
<tr><td>Misalignment</td><td>Segment fatter or smaller or extra segment</td><td>Reject if > 10% of designed segment width and visible at 30cm distance</td><td></td></tr>
<tr><td>Pin Hole</td><td>Pin hole / void at light up segment</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 ≤ 0.10mm</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>
</td><td> 

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

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	

12.2.5 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				

12.2.6 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

13. Precaution for using LCM

1. Liquid Crystal Display (LCD)

LCD is made up of glass, organic sealant, organic fluid and polymer based polarizers. The following precautions should be taken when handling.

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

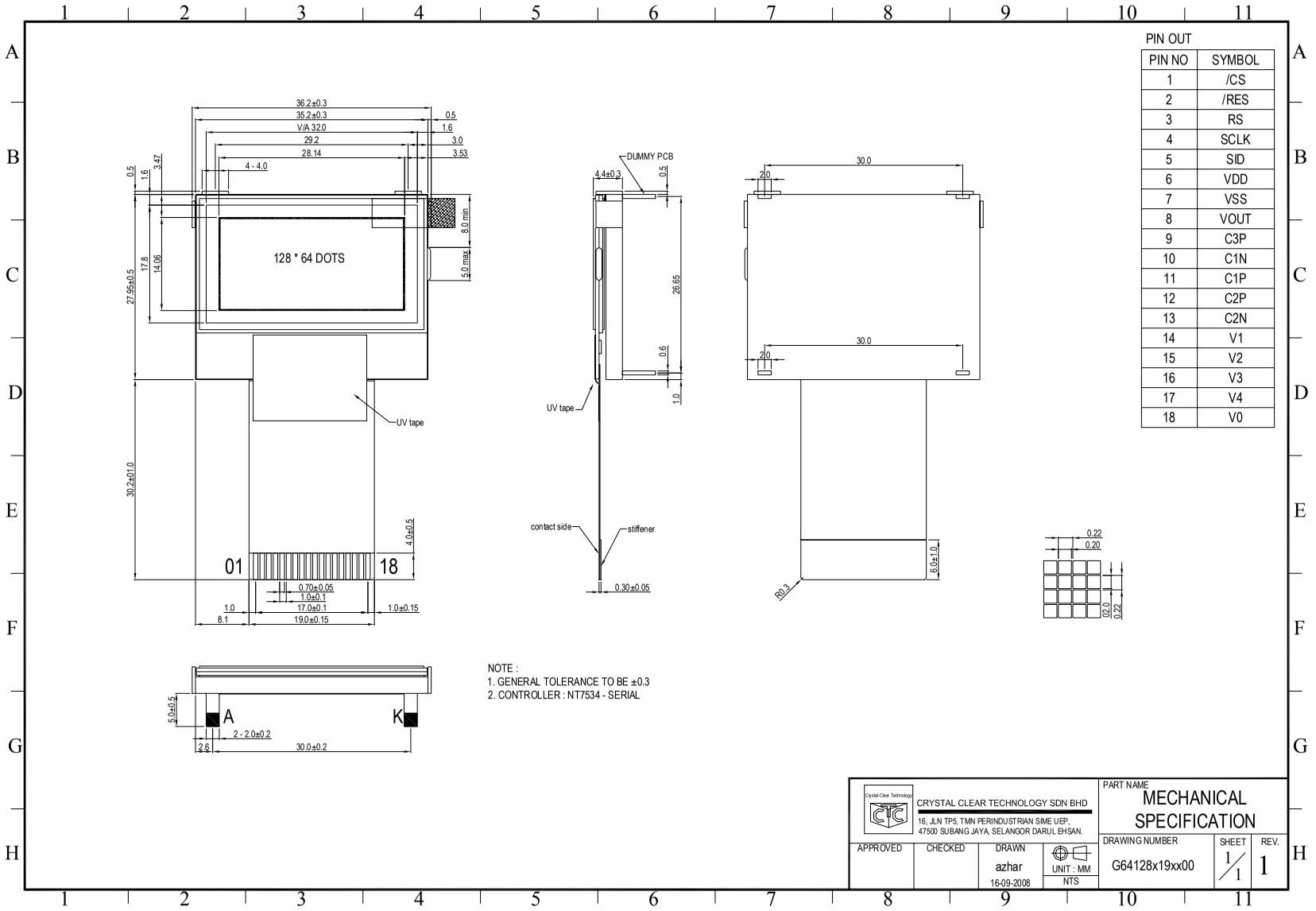
a) The contras can be adjusted by varying the LCD driving voltage V0
b) Driving voltage should be kept within specified range, excess voltage shortens display life.
c) Response time increases with decrease in temperature.
d) Display may turn black or dark blue at temperature above its operational range,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



PIN OUT

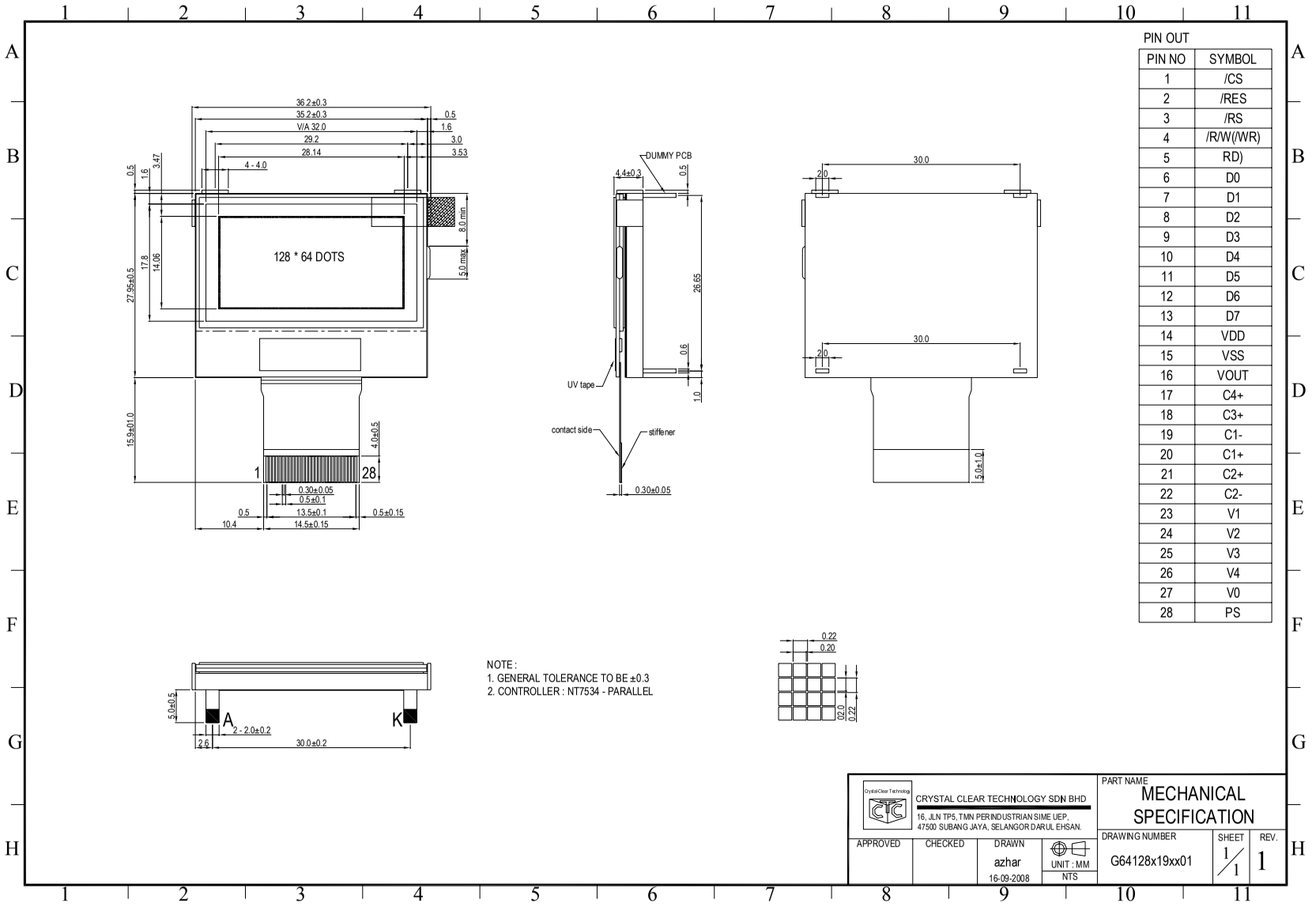
PIN NO	SYMBOL
1	/CS
2	/RES
3	RS
4	SCLK
5	SID
6	VDD
7	VSS
8	VOUT
9	C3P
10	C1N
11	C1P
12	C2P
13	C2N
14	V1
15	V2
16	V3
17	V4
18	V0

NOTE :
1. GENERAL TOLERANCE TO BE ±0.3
2. CONTROLLER : NT7534 - SERIAL

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	UNIT : MM	DRAWING NUMBER	SHEET	REV.
		azhar 16-09-2008	NTS	G64128x19xx00	1/1	1



PIN OUT

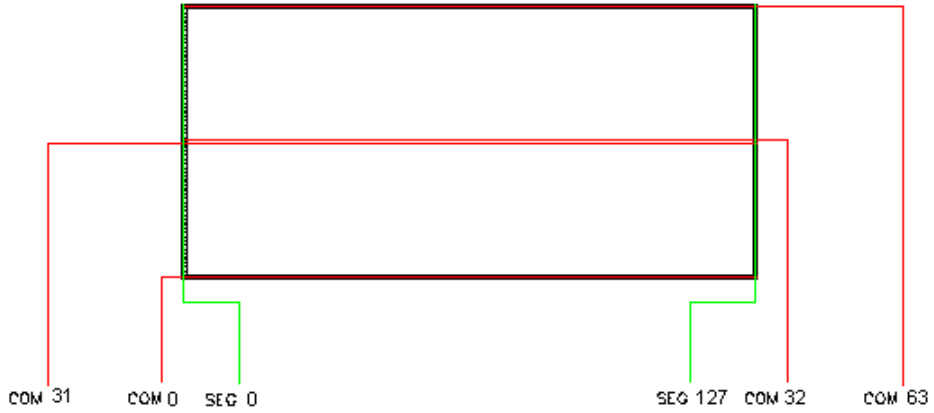
PIN NO	SYMBOL
1	/CS
2	/RES
3	/RS
4	/R/W(/WR)
5	RD)
6	D0
7	D1
8	D2
9	D3
10	D4
11	D5
12	D6
13	D7
14	VDD
15	VSS
16	VOUT
17	C4+
18	C3+
19	C1-
20	C1+
21	C2+
22	C2-
23	V1
24	V2
25	V3
26	V4
27	V0
28	PS

NOTE :
1. GENERAL TOLERANCE TO BE ±0.3
2. CONTROLLER : NT7534 - PARALLEL

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	UNIT : MM	DRAWING NUMBER	SHEET	REV.
		azhar 16-09-2008	NTS	G64128x19xx01	1/1	1



LCD Segment and Common Layout

Crystal Clear Technology

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