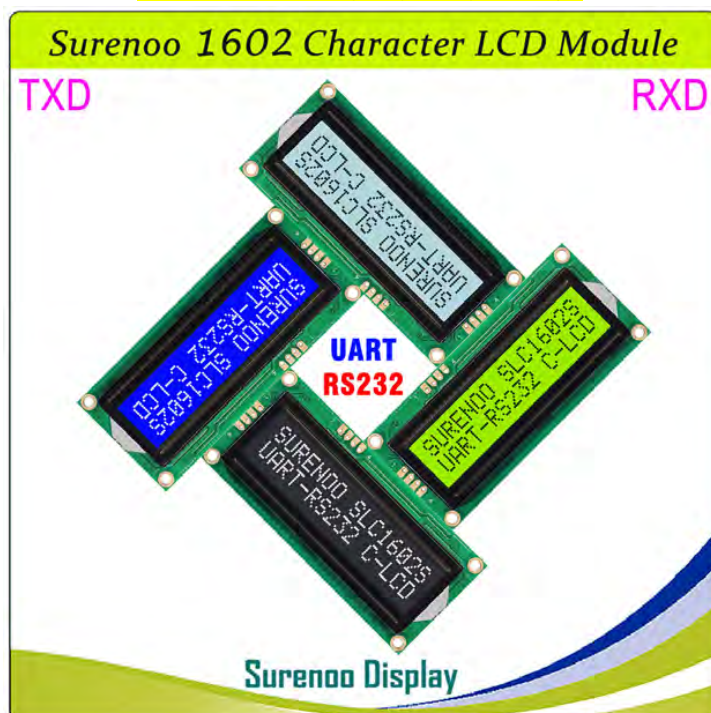


SURENOO DISPLAY USER MANUAL

SLC1602S Series

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[Surennoo RS232/UART\(TTL\) Shield "User Manual"](#)



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www.surennoo.com

Surennoo Character LCD Selection Guide

Y 01	08X01	16X01			
Y 02	08X02	16X02	20X02	24X02	40X02
Y 03					
Y 04		16X04	20X04		40X04
	X 08	X 16	X 20	X 24	X 40

Surenno Character LCD Module List (1602: 1/2)

 Surenno 1602 Character LCD Module	 Surenno 1602 Character LCD Module	 Surenno 1602 Character LCD Module	 Surenno 1602 Character LCD Module
Model No.: SLC1602A1 Controller: AIP31066 or Equal Interface: 4-/8- Bit Parallel Outline Size: 80.00*36.00MM Extend Function: IIC, LCD2USB, RS232/UART 	Model No.: SLC1602A2 Controller: AIP31066 or Equal Interface: 4-/8- Bit Parallel Outline Size: 80.00*36.00MM Keyword: RGB Backlight 	Model No.: SLC1602B Controller: AIP31066 or Equal Interface: 4-/8- Bit Parallel Outline Size: 122.00*44.00MM Extend Function: IIC, LCD2USB, RS232/UART 	Model No.: SLC1602C Controller: AIP31066 or Equal Interface: 4-/8- Bit Parallel Outline Size: 80.00*36.00MM Keyword: Up and Down Interface
 Surenno 1602 Character LCD Module	 Surenno 1602 Character LCD Module	 Surenno 1602 Character LCD Module	 Surenno 1602 Character LCD Module
Model No.: SLC1602D Controller: AIP31066 or Equal Interface: 4-/8- Bit Parallel Outline Size: 84.00*44.00MM Keyword: - 	Model No.: SLC1602E1 Controller: AIP31066 or Equal Interface: 4-/8- Bit Parallel Outline Size: 85.00*30.00MM Keyword: - 	Model No.: SLC1602E2 Controller: AIP31066 or Equal Interface: 4-/8- Bit Parallel Outline Size: 85.00*30.00MM Keyword: RGB Backlight 	Model No.: SLC1602F Controller: - Interface: RS232/UART(CMOS) Outline Size: 80.00*36.00MM Keyword: for Arduino
 Surenno 1602 Character LCD Module	 Surenno 1602 Character LCD Module	 Surenno 1602 Character LCD Module	 Surenno 1602 Character LCD Module
Model No.: SLC1602G Controller: AIP31068 or Equal Interface: Serial IIC/SPI Outline Size: 80.00*36.00MM Keyword: for Arduino 	Model No.: SLC1602H Controller: AIP31068 or Equal Interface: Serial IIC/SPI Outline Size: 80.00*36.00MM Keyword: for Arduino 	Model No.: SLC1602I Controller: ST7032S or Equal Interface: Serial SPI Outline Size: 41.50*33.30/24.30MM Keyword: COG (3.3V) 	Model No.: SLC1602J Controller: AIP31068 or Equal Interface: Serial IIC/SPI Outline Size: 80.00*36.00MM Keyword: for Arduino

Surenno Character LCD Module List (1602: 2/2)

 Surenno 1602 Character LCD Module IIC Interface Surenno Display	 Surenno 1602 Character LCD Module 7 in 1 Display in 7 Colors Surenno Display	 Surenno 1602 Character LCD Module PH2.0/4Pin Surenno Display	 Surenno 1602 Character LCD Module Small Size Surenno Display
Model No.: SLC1602K Controller: ST7032 or Equal Interface: Serial IIC Outline Size: 66.70*37.46MM (K3) Keyword: COG, for Arduino 	Model No.: SLC1602L Controller: AIP31066 or Equal Interface: 4-/8- Bit Parallel Outline Size: 80.00*36.00MM Keyword: RGB Backlight 	Model No.: SLC1602M Controller: AIP31068 or Equal Interface: Serial IIC Outline Size: 87.00*32.00MM Keyword: PH2.0/4Pin 	Model No.: SLC1602N Controller: AIP31066 or Equal Interface: 4-/8- Bit Parallel Outline Size: 58.00*20.00MM Keyword: Small Size, IIC is Optional
 Surenno 1602 Character LCD Module RGB Surenno Display	 Surenno 1602 Character LCD Module IIC LCD Surenno Display	 Surenno 1602 Character LCD Module VA Full Angle Surenno Display	 Surenno 1602 Character LCD Module C-LCD Surenno Display
Model No.: SLC1602O Controller: AIP31068 or Equal Interface: Serial IIC Outline Size: 80.00*36.00MM Keyword: RGB Backlight, for Arduino 	Model No.: SLC1602P Controller: RW1063 or Equal Interface: Serial IIC Outline Size: 86.00*30.00MM Keyword: for Arduino 	Model No.: SLC1602Q Controller: AIP31066 & PCF8574T Interface: 4-/8- Bit Parallel & Serial IIC Outline Size: 80.00*36.00MM Keyword: for Arduino, VA Full Angle 	Model No.: SLC1602R Controller: AIP31066 & PCF8574T Interface: Serial IIC Outline Size: 80.00*36.00MM Keyword: for Arduino
 Surenno 1602 Character LCD Module UART (TTL) RS232 Surenno Display			
Model No.: SLC1602S Controller: AIP31066 or Equal Interface: Serial RS232/UART(TTL) Outline Size: 80.00*36.00MM Keyword: - 			

Contents

- 1.Precautions in use of LCD Modules
- 2.General Specification
- 3.Absolute Maximum Ratings
- 4.Electrical Characteristics
- 5.Optical Characteristics
- 6.Interface Pin Function
- 7.Contour Drawing
- 8.Character Generator ROM Pattern
- 9.Reliability
- 10.Backlight Information
- 11.Inspection specification
- 12.Material List of Components for RoHs
- 13.Recommendable Storage
- 14.Communication Information

01. Precautions in use of LCD Modules

- (01) Avoid applying excessive shocks to the module or making any alterations or modifications to it.
- (02) Don't make extra holes on the printed circuit board, modify its shape or change the components of LCD Module.
- (03) Don't disassemble the LCD Module.
- (04) Don't operate it above the absolute maximum rating.
- (05) Don't drop, bend or twist LCD Module.
- (06) Soldering: only to the I/O terminals.
- (07) Storage: please storage in anti-static electricity container and clean environment.
- (08) Surenoo have the right to change the passive components, including backlight adjust resistors. (Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.)
- (09) Surenoo have the right to change the PCB Rev.(In order to satisfy the supplying stability, management optimization and the best product performance... etc, under the premise of not affecting the electrical characteristics and external dimensions, Surenoo have the right to modify the version.)
- (10) To ensure the stability of the display screen, please apply screen saver after showing 30 mins of fixed display content.
- (11) Please heat up a little the tape sticking on the components when removing it; otherwise the components might be damaged.

02. General Specification

Item	Dimension	Unit
Number of Characters	16 characters x 2Lines	—
Module dimension	80.0 x 36.0 x 12.1 (MAX)	mm
View area	64.5 x 16.0	mm
Active area	58.21 x 12.51	mm
Dot size	0.61 x 0.71	mm
Dot pitch	0.66 x 0.76	mm
Character size	3.25 x 6.03	mm
Character pitch	3.664 x 3.25	mm
LCD type	STN Negative, Blue Transmissive (In LCD production, It will occur slightly color difference. We can only guarantee the same color in the same batch.)	
Duty	1/16	
View direction	6 o'clock	
Backlight Type	LED White	
Controller IC	AIP31066	
Interface	232 / UART(9600bps)	

03. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T _{OP}	-20	—	+70	°C
Storage Temperature	T _{ST}	-30	—	+80	°C
Supply Voltage	—	V _{SS} -0.3	—	6.0	V
EEPROM Cell Endurance	—	100K	—	—	E/W
Input Voltage	—	V _{SS} -0.3	—	V _{DD} +0.3	V

*Note: “E/W” means Erase/Write times

04. Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	V _{DD} -V _{SS}	—	4.5	5.0	5.5	V
Supply Voltage For LCD	V _{DD} -V _O	T _a =25°C	3.6	3.7	3.8	V
Input High Voltage	V _{IH}	—	3.5	—	5.0	V
Input Low Voltage	V _{IL}	—	0	—	1.5	V
Supply Current (Module + Backlight) *Note	I _{DD}	V _{DD} =5.0V	—	—	45	mA

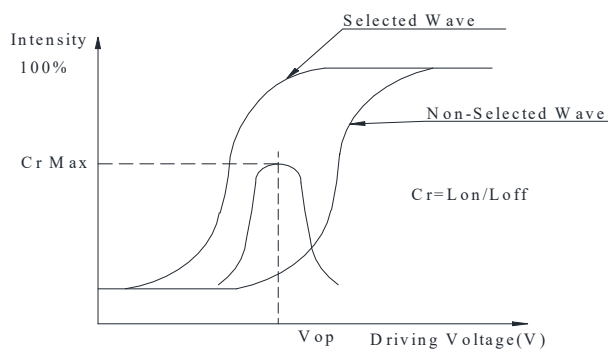
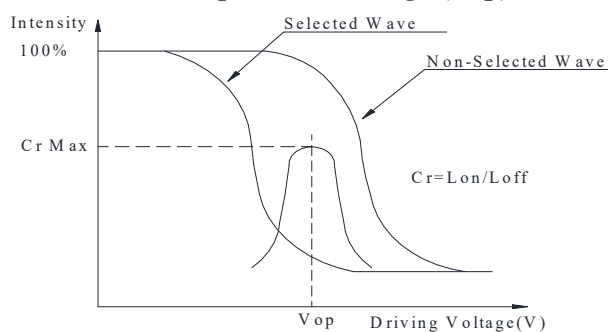
*Note : Backlight 100% turn on.

*Software functionally adjusts LCD contrast.

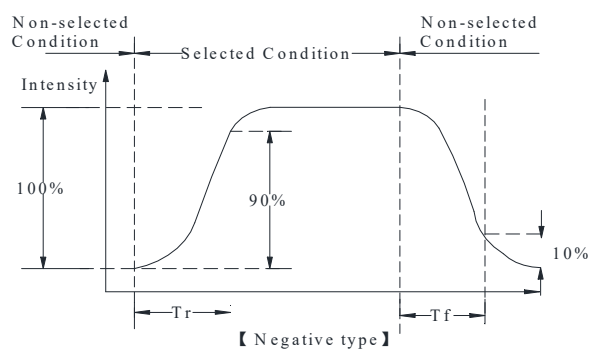
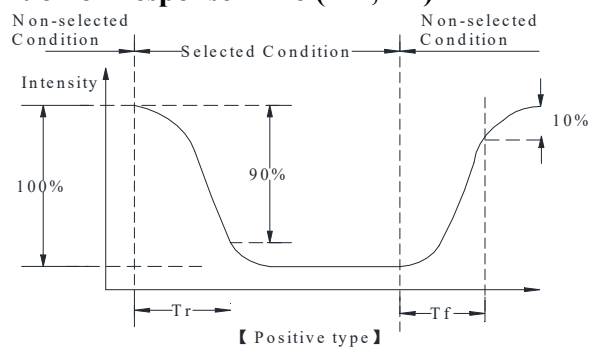
05. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	θ	$CR \geq 2$	0	—	20	$\psi = 180^\circ$
	θ	$CR \geq 2$	0	—	40	$\psi = 0^\circ$
	θ	$CR \geq 2$	0	—	30	$\psi = 90^\circ$
	θ	$CR \geq 2$	0	—	30	$\psi = 270^\circ$
Contrast Ratio	CR	—	—	3	—	—
Response Time	T rise	—	—	150	200	ms
	T fall	—	—	150	200	ms

Definition of Operation Voltage (Vop)



Definition of Response Time (Tr, Tf)



Conditions :

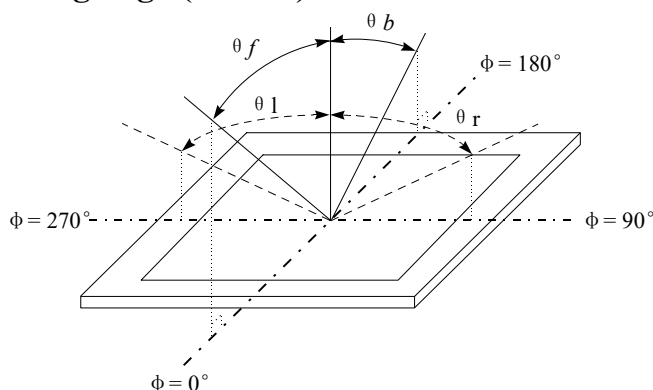
Operating Voltage : Vop

Viewing Angle (θ , ϕ) : 0° , 0°

Frame Frequency : 64 HZ

Driving Waveform : 1/N duty, 1/a bias

Definition of viewing angle($CR \geq 2$)

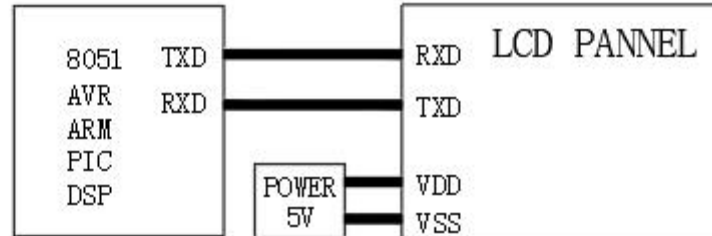
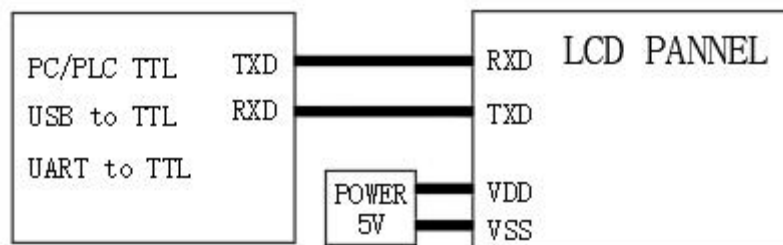


06. Interface Pin Function

CON1(CON2):

Pin No.	SYMBOL	LEVEL	FUNCTION
1	VSS	0V	Ground
2	VDD	+5.0V	Supply Voltage
3	TXD	H/L	UART: serial data output
4	RXD	H/L	UART: serial data input (full duplex communication)

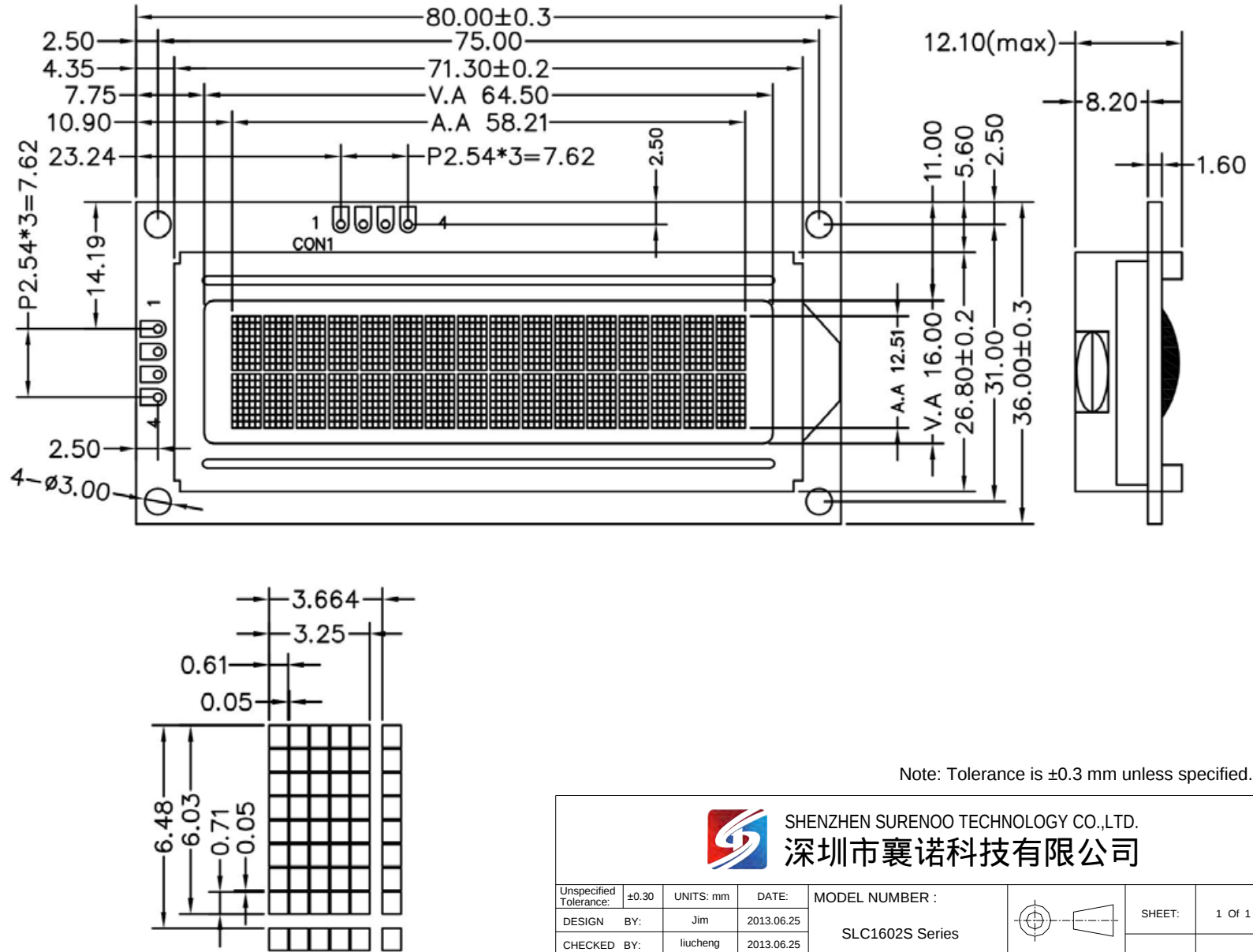
Default: Baud rate(04:9600bps), Contrast Setting(03), Backlight Setting(04).





07. Contour Drawing

All Pages Of This Edition Approved			
Signature:		Date:	



Note: Tolerance is ±0.3 mm unless specified.



SHENZHEN SURENOO TECHNOLOGY CO.,LTD.
深圳市襄诺科技有限公司

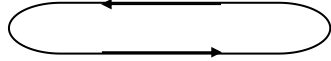
Unspecified Tolerance:	±0.30	UNITS: mm	DATE:	MODEL NUMBER :		SHEET:	1 Of 1
DESIGN BY:	Jim	2013.06.25	CHECKED BY:	liucheng		DATE:	2013.06.25
APPROVED BY:				DO NOT SCALE THIS DRAWING.	PROJECTION		

08. Character Generator ROM Pattern

Upper 4 bit Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL	CG RAM (1)			0	1	2	3	4				5	6	7	8	9
LLLH	(2)		:	A	B	C	D	E			F	G	H	I	J	K
LLHL	(3)		"	2	B	R	b	r			7	i	u	x	pe	ea
LLHH	(4)		#	3	C	S	c	s			J	u	7	e	e	o
LHLL	(5)		\$	4	D	T	d	t			\	E	T	4	W	o
LHLH	(6)		%	5	E	U	e	u			.	o	7	u	e	o
LHHL	(7)		&	6	F	V	f	v			@	7	2	3	4	5
LHHH	(8)		'	7	G	W	g	w			7	7	7	7	7	7
HLLL	(1)		(	8	H	X	h	x			/	7	7	7	7	7
HLLH	(2)		)	9	I	Y	i	y			7	7	7	7	7	7
HLHL	(3)		*	0	J	Z	j	z			7	7	7	7	7	7
HLHH	(4)		+	1	K	L	k	l			7	7	7	7	7	7
HHLL	(5)		,	<	L	7	l	7			7	7	7	7	7	7
HHLH	(6)		-	=	M	N	m	n			7	7	7	7	7	7
HHHL	(7)		.	>	N	7	n	7			7	7	7	7	7	7
HHHH	(8)		/	7	O	7	o	7			7	7	7	7	7	7

09. Reliability

Content of Reliability Test (Wide temperature, -20℃~70℃)

Environmental Test			
Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80℃ 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30℃ 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70℃ 200hrs	— —
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20℃ 200hrs	1
High Temperature/ Humidity storage	The module should be allowed to stand at 60℃,90%RH max For 96hrs under no-load condition excluding the polarizer, Then taking it out and drying it at normal temperature.	60℃,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation -20℃ 25℃ 70℃  30min 5min 30min 1 cycle	-20℃/70℃ 10 cycles	— —
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±600V(contact), ±800v(air), RS=330 Ω CS=150pF 10 times	— —

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

10. Backlight Information

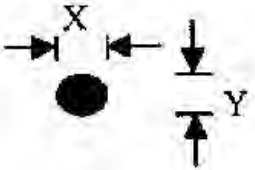
Specification

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Luminance (Without LCD)	IV	496	620	—	cd/m ²	(Note 1)
LED Life Time (For Reference only)	—	—	50K	—	Hr.	25°C,50-60%RH, (Note 2)
Color	White					

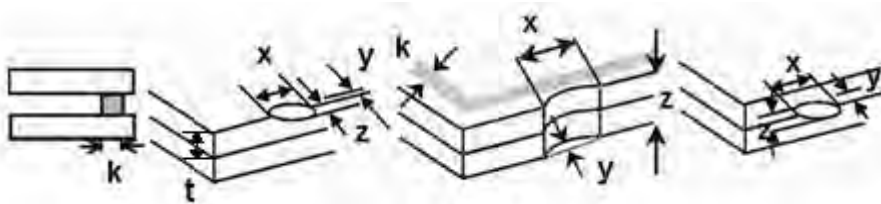
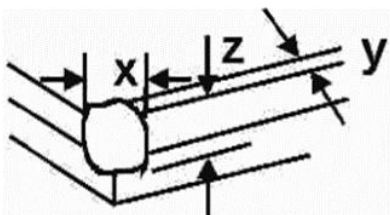
Note 1: Software functionally adjusts backlight luminance

Note 2:50K hours is only an estimate for reference.

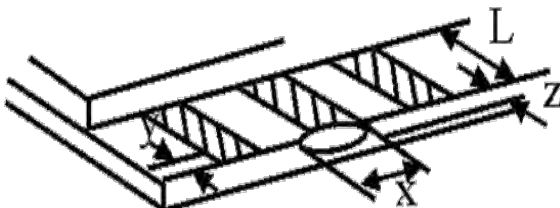
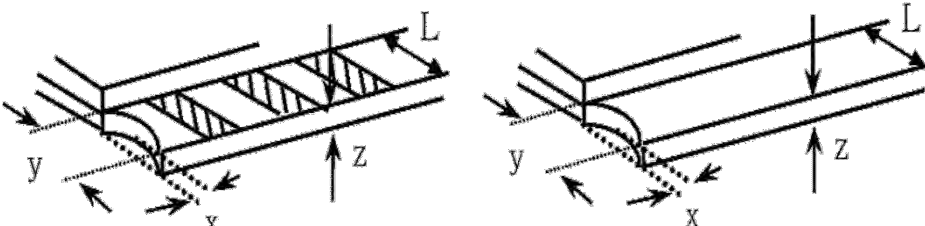
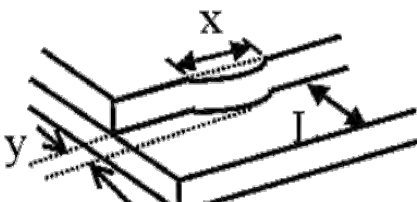
11. Inspection Specification

No	Item	Criterion	AQL																								
01	Electrical Testing	Missing vertical, horizontal segment, segment contrast defect. Missing character , dot or icon. Display malfunction. No function or no display. Current consumption exceeds product specifications. LCD viewing angle defect. Mixed product types. Contrast defect.	0.65																								
02	Black or white spots on LCD (display only)	2.1 White and black spots on display $\leq 0.25\text{mm}$, no more than three white or black spots present. 2.2 Densely spaced: No more than two spots or lines within 3mm	2.5																								
03	LCD black spots, white spots, contamination (non-display)	3.1 Round type : As following drawing $\Phi=(x+y)/2$ <table><tr><th>Size</th><th>Acceptable QTY</th></tr><tr><td>$\Phi \leq 0.10$</td><td>Accept no dense</td></tr><tr><td>$0.10 < \Phi \leq 0.20$</td><td>2</td></tr><tr><td>$0.20 < \Phi \leq 0.25$</td><td>1</td></tr><tr><td>$0.25 < \Phi$</td><td>0</td></tr></table> 3.2 Line type : (As following drawing) <table><tr><th>Length</th><th>Width</th><th>Acceptable QTY</th></tr><tr><td>---</td><td>$W \leq 0.02$</td><td>Accept no dense</td></tr><tr><td>$L \leq 3.0$</td><td>$0.02 < W \leq 0.03$</td><td rowspan="2">2</td></tr><tr><td>$L \leq 2.5$</td><td>$0.03 < W \leq 0.05$</td></tr><tr><td>---</td><td>$0.05 < W$</td><td>As round type</td></tr></table>	Size	Acceptable QTY	$\Phi \leq 0.10$	Accept no dense	$0.10 < \Phi \leq 0.20$	2	$0.20 < \Phi \leq 0.25$	1	$0.25 < \Phi$	0	Length	Width	Acceptable QTY	---	$W \leq 0.02$	Accept no dense	$L \leq 3.0$	$0.02 < W \leq 0.03$	2	$L \leq 2.5$	$0.03 < W \leq 0.05$	---	$0.05 < W$	As round type	2.5
Size	Acceptable QTY																										
$\Phi \leq 0.10$	Accept no dense																										
$0.10 < \Phi \leq 0.20$	2																										
$0.20 < \Phi \leq 0.25$	1																										
$0.25 < \Phi$	0																										
Length	Width	Acceptable QTY																									
---	$W \leq 0.02$	Accept no dense																									
$L \leq 3.0$	$0.02 < W \leq 0.03$	2																									
$L \leq 2.5$	$0.03 < W \leq 0.05$																										
---	$0.05 < W$	As round type																									
04	Polarizer bubbles	If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction. <table><tr><th>Size Φ</th><th>Acceptable QTY</th></tr><tr><td>$\Phi \leq 0.20$</td><td>Accept no dense</td></tr><tr><td>$0.20 < \Phi \leq 0.50$</td><td>3</td></tr><tr><td>$0.50 < \Phi \leq 1.00$</td><td>2</td></tr><tr><td>$1.00 < \Phi$</td><td>0</td></tr><tr><td>Total QTY</td><td>3</td></tr></table>	Size Φ	Acceptable QTY	$\Phi \leq 0.20$	Accept no dense	$0.20 < \Phi \leq 0.50$	3	$0.50 < \Phi \leq 1.00$	2	$1.00 < \Phi$	0	Total QTY	3	2.5												
Size Φ	Acceptable QTY																										
$\Phi \leq 0.20$	Accept no dense																										
$0.20 < \Phi \leq 0.50$	3																										
$0.50 < \Phi \leq 1.00$	2																										
$1.00 < \Phi$	0																										
Total QTY	3																										



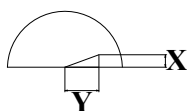
No	Item	Criterion	AQL																		
05	Scratches	Follow NO.3 LCD black spots, white spots, contamination																			
06	Chipped glass	Symbols Define: x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: LCD side length L: Electrode pad length: 6.1 General glass chip : 6.1.1 Chip on panel surface and crack between panels:  <table> <tr> <th>z: Chip thickness</th> <th>y: Chip width</th> <th>x: Chip length</th> </tr> <tr> <td>$Z \leq 1/2t$</td> <td>Not over viewing area</td> <td>$x \leq 1/8a$</td> </tr> <tr> <td>$1/2t < z \leq 2t$</td> <td>Not exceed 1/3k</td> <td>$x \leq 1/8a$</td> </tr> </table> ⊙ If there are 2 or more chips, x is total length of each chip. 6.1.2 Corner crack:  <table> <tr> <th>z: Chip thickness</th> <th>y: Chip width</th> <th>x: Chip length</th> </tr> <tr> <td>$Z \leq 1/2t$</td> <td>Not over viewing area</td> <td>$x \leq 1/8a$</td> </tr> <tr> <td>$1/2t < z \leq 2t$</td> <td>Not exceed 1/3k</td> <td>$x \leq 1/8a$</td> </tr> </table> ⊙ If there are 2 or more chips, x is the total length of each chip.	z: Chip thickness	y: Chip width	x: Chip length	$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$	$1/2t < z \leq 2t$	Not exceed 1/3k	$x \leq 1/8a$	z: Chip thickness	y: Chip width	x: Chip length	$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$	$1/2t < z \leq 2t$	Not exceed 1/3k	$x \leq 1/8a$	2.5
z: Chip thickness	y: Chip width	x: Chip length																			
$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$																			
$1/2t < z \leq 2t$	Not exceed 1/3k	$x \leq 1/8a$																			
z: Chip thickness	y: Chip width	x: Chip length																			
$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$																			
$1/2t < z \leq 2t$	Not exceed 1/3k	$x \leq 1/8a$																			



No	Item	Criterion	AQL																
06	Glass crack	Symbols : x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: LCD side length L: Electrode pad length 6.2 Protrusion over terminal : 6.2.1 Chip on electrode pad :  <table border="1"> <tr> <th>y: Chip width</th> <th>x: Chip length</th> <th>z: Chip thickness</th> </tr> <tr> <td>$y \leq 0.5\text{mm}$</td> <td>$x \leq 1/8a$</td> <td>$0 < z \leq t$</td> </tr> </table> 6.2.2 Non-conductive portion:  <table border="1"> <tr> <th>y: Chip width</th> <th>x: Chip length</th> <th>z: Chip thickness</th> </tr> <tr> <td>$y \leq L$</td> <td>$x \leq 1/8a$</td> <td>$0 < z \leq t$</td> </tr> </table> ○If the chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications. ○If the product will be heat sealed by the customer, the alignment mark not be damaged. 6.2.3 Substrate protuberance and internal crack. <table border="1"> <tr> <th>y: width</th> <th>x: length</th> </tr> <tr> <td>$y \leq 1/3L$</td> <td>$x \leq a$</td> </tr> </table> 	y: Chip width	x: Chip length	z: Chip thickness	$y \leq 0.5\text{mm}$	$x \leq 1/8a$	$0 < z \leq t$	y: Chip width	x: Chip length	z: Chip thickness	$y \leq L$	$x \leq 1/8a$	$0 < z \leq t$	y: width	x: length	$y \leq 1/3L$	$x \leq a$	2.5
		y: Chip width	x: Chip length	z: Chip thickness															
		$y \leq 0.5\text{mm}$	$x \leq 1/8a$	$0 < z \leq t$															
		y: Chip width	x: Chip length	z: Chip thickness															
$y \leq L$	$x \leq 1/8a$	$0 < z \leq t$																	
y: width	x: length																		
$y \leq 1/3L$	$x \leq a$																		



No	Item	Criterion	AQL
07	Cracked glass	The LCD with extensive crack is not acceptable.	2.5
08	Backlight elements	8.1 Illumination source flickers when lit.	0.65
		8.2 Spots or scratched that appear when lit must be judged. Using LCD spot, lines and contamination standards.	2.5
		8.3 Backlight doesn't light or color wrong.	0.65
09	Bezel	9.1 Bezel may not have rust, be deformed or have fingerprints, stains or other contamination.	2.5
		9.2 Bezel must comply with job specifications.	0.65
10	PCB、COB	10.1 COB seal may not have pinholes larger than 0.2mm or contamination.	2.5
		10.2 COB seal surface may not have pinholes through to the IC.	2.5
		10.3 The height of the COB should not exceed the height indicated in the assembly diagram.	0.65
		10.4 There may not be more than 2mm of sealant outside the seal area on the PCB. And there should be no more than three places.	2.5
		10.5 No oxidation or contamination PCB terminals.	2.5
		10.6 Parts on PCB must be the same as on the production characteristic chart. There should be no wrong parts, missing parts or excess parts.	0.65
		10.7 The jumper on the PCB should conform to the product characteristic chart.	0.65
		10.8 If solder gets on bezel tab pads, LED pad, zebra pad or screw hold pad, make sure it is smoothed down.	2.5
		10.9 The Scraping testing standard for Copper Coating of PCB	2.5
11	Soldering	11.1 No un-melted solder paste may be present on the PCB.	2.5
		11.2 No cold solder joints, missing solder connections, oxidation or icicle.	2.5
		11.3 No residue or solder balls on PCB.	2.5
		11.4 No short circuits in components on PCB.	0.65



$$X * Y \leq 2\text{mm}^2$$



NO	Item	Criterion	AQL
12	General appearance	12.1 No oxidation, contamination, curves or, bends on interface Pin (OLB) of TCP.	2.5
		12.2 No cracks on interface pin (OLB) of TCP.	0.65
		12.3 No contamination, solder residue or solder balls on product.	2.5
		12.4 The IC on the TCP may not be damaged, circuits.	2.5
		12.5 The uppermost edge of the protective strip on the interface pin must be present or look as if it cause the interface pin to sever.	2.5
		12.6 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color.	2.5
		12.7 Sealant on top of the ITO circuit has not hardened.	2.5
		12.8 Pin type must match type in specification sheet.	0.65
		12.9 LCD pin loose or missing pins.	0.65
		12.10 Product packaging must the same as specified on packaging specification sheet.	0.65
		12.11 Product dimension and structure must conform to product specification sheet.	0.65
		12.12 Visual defect outside of VA is not considered to be rejection.	0.65

12. Material List of Components for RoHS

1. Shenzhen Surenoo Technology Co.,Ltd hereby declares that all of or part of products(with the mark “#”in code), including, but not limited to, the LCM, accessories or packages, manufactured and/or delivered to your company (including your subsidiaries and affiliated company) directly or indirectly by our company (including our subsidiaries or affiliated companies) do not intentionally contain any of the substances listed in all applicable EU directives and regulations, including the following substances.

Exhibit A: The Harmful Material List

Material	Cd	Pb	Hg	Cr6+	PBB	PBDE	DEHP	BBP	DBP	DIBP
Limited Value	100 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm

Above limited value is set up according to RoHS.

2. Process for RoHS requirement: **(only for RoHS inspection)**

- (1) Use the Sn/Ag/Cu soldering surface; the surface of Pb-free solder is rougher than we used before.
- (2) Heat-resistance temp.:
Reflow: 250°C,30 seconds Max.;
Connector soldering wave or hand soldering: 320°C, 10 seconds max.
- (3) Temp. curve of reflow, max. Temp.: 235±5°C;
Recommended customer's soldering temp. of connector: 280°C, 3 seconds.

13. Recommendable Storage

1. Place the panel or module in the temperature 25°C±5°C and the humidity below 65% RH
2. Do not place the module near organics solvents or corrosive gases.
3. Do not crush, shake, or jolt the module.

14. Communication Information

This module has a built-in MCU for serial communication. It provides UART protocols. Additionally, the built-in MCU requires a 180ms time upon power-up to initialize the module.

1. UART protocol

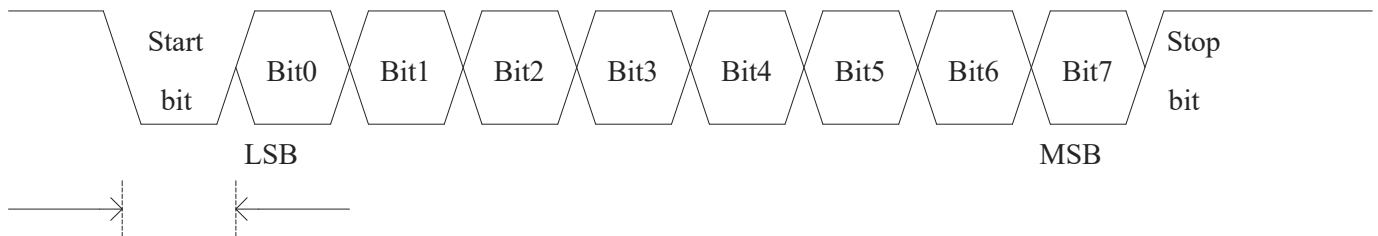
To enter UART Mode, place jumpers on both JB0 and JB1.

Communication format is 8-bit data, no parity, 1 stop bit and no handshaking.

The default baud rate of UART is 9600bps, and it supports five different baud rates: 4800, 9600, 14400, 19200, 57600, and 115200bps.

The default baud rate can be restored if Self-Test mode is selected.

UART format is follows:



When the Baud Rate is 4800bps, the width of each bit is $1/4800$ seconds

When the Baud Rate is 9600bps, the width of each bit is $1/9600$ seconds.

When the Baud Rate is 14400bps, the width of each bit is $1/14400$ seconds

When the Baud Rate is 19200bps, the width of each bit is $1/19200$ seconds

When the Baud Rate is 57600bps, the width of each bit is $1/57600$ seconds

When the Baud Rate is 115200bps, the width of each bit is $1/115200$ seconds



14.1. Instruction

1. Instruction List

NO.	Description	Start character	Command	Column	ROW	Parameter		End character	
1	Display Character	0x00 0x00 0x00	0x40	0x00 ~ 0x0F	0x00 ~ 0x01	0x00 ~ 0xFF		0x0A 0x0D	
2	Display On	0x00 0x00 0x00	0x41	—	—	—		0x0A 0x0D	
3	Display Off	0x00 0x00 0x00	0x42	—	—	—		0x0A 0x0D	
4	Set Cursor Position	0x00 0x00 0x00	0x45	0x00 ~ 0x0F	0x00 ~ 0x01	—		0x0A 0x0D	
5	Cursor Home	0x00 0x00 0x00	0x46	—	—	—		0x0A 0x0D	
6	Cursor On	0x00 0x00 0x00	0x47	—	—	—		0x0A 0x0D	
7	Cursor Off	0x00 0x00 0x00	0x48	—	—	—		0x0A 0x0D	
8	Cursor Shift Left	0x00 0x00 0x00	0x49	—	—	—		0x0A 0x0D	
9	Cursor Shift Right	0x00 0x00 0x00	0x4A	—	—	—		0x0A 0x0D	
10	Cursor Blink On	0x00 0x00 0x00	0x4B	—	—	—		0x0A 0x0D	
11	Cursor Blink Off	0x00 0x00 0x00	0x4C	—	—	—		0x0A 0x0D	
12	Backspace	0x00 0x00 0x00	0x4E	—	—	—		0x0A 0x0D	
13	Clear Display	0x00 0x00 0x00	0x51	—	—	0x01 ~ 0x03		0x0A 0x0D	
14	Contrast Setting	0x00 0x00 0x00	0x52	—	—	0x01 ~ 0x08		0x0A 0x0D	
15	Backlight Setting	0x00 0x00 0x00	0x53	—	—	0x01 ~ 0x08		0x0A 0x0D	
16	Set Custom Character	0x00 0x00 0x00	0x54	0x00 ~ 0x0F	0x00 ~ 0x01	0x00 ~ 0x07	8 Byte	0x0A 0x0D	
17	Shift Display Left	0x00 0x00 0x00	0x55	—	—	—		0x0A 0x0D	
18	Shift Display Right	0x00 0x00 0x00	0x56	—	—	—		0x0A 0x0D	
19	Change Baud Rate	0x00 0x00 0x00	0x61	—	—	0x03 ~ 0x08		0x0A 0x0D	

Default: Baud rate(04:9600bps), Contrast Setting(05), Backlight Setting(04).

14.2. Instruction Description

1. Display Character

Description	The LCD display displays the ASCII code.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x40	0x00 ~ 0x0F	0x00 ~ 0x01	'A'	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x40	0x00	0x00	0x41	0x0A 0x0D

2. Display On

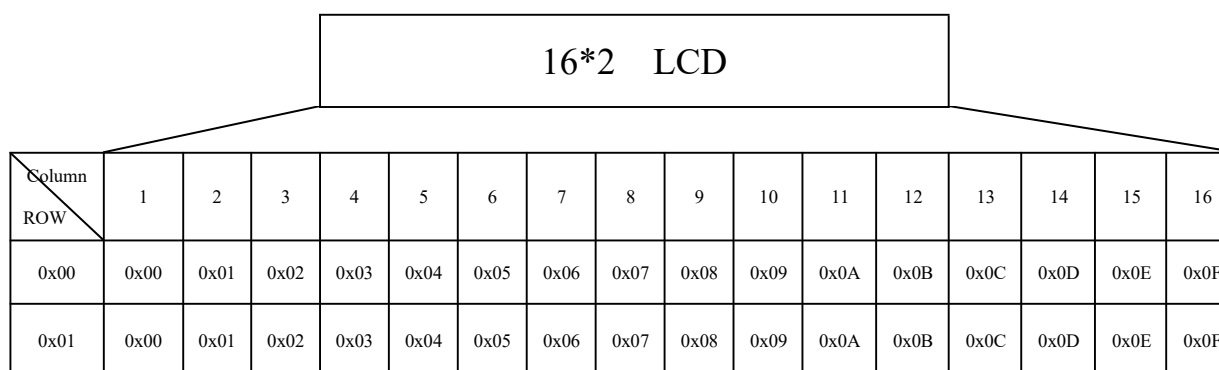
Description	This command turns on the LCD display screen.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x41	—	—	—	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x41	—	—	—	0x0A 0x0D

3. Display Off

Description	This command turns off the LCD display screen, but the displayed text is not altered.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x42	—	—	—	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x42	—	—	—	0x0A 0x0D

4. Set Cursor Position

Description	This command moves the cursor to specific position. After the reset, the cursor is on position 0x00.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x45	—	—	—	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x45	—	—	—	0x0A 0x0D



5. Cursor Home

Description	This command moves the cursor to line 1, column 1 of the LCD.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x46	—	—	None	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x46	—	—	—	0x0A 0x0D

6. Cursor On

Description	This command turns on the underline cursor. Cursor default value is off.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x47	—	—	None	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x47	—	—	—	0x0A 0x0D

7. Cursor Off

Description	This command turns off the underline cursor. Cursor default value is off.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x48	—	—	None	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x48	—	—	—	0x0A 0x0D

8. Cursor Shift Left

Description	This command moves the cursor position left 1 space whether the cursor is turned on or off, and the displayed text is not altered.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x49	—	—	None	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x49	—	—	—	0x0A 0x0D

9. Cursor Shift Right

Description	This command moves the cursor position right 1 space whether the cursor is turned on or off, and the displayed text is not altered.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x4A	—	—	None	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x4A	—	—	—	0x0A 0x0D

10. Cursor Blink On

Description	This command turns on the blinking cursor. Cursor blink default value is off.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x4B	—	—	None	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x4B	—	—	—	0x0A 0x0D

11. Cursor Blink Off

Description	This command turns off the blinking cursor. Cursor blink default value is off.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x4C	—	—	None	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x4C	—	—	—	0x0A 0x0D

12. Backspace

Description	This command is destructive backspace. The cursor is moved back one space and the character on the cursor is deleted.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x4E	—	—	None	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x4E	—	—	—	0x0A 0x0D

13. Clear Display

Description	This command clears the entire display					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x51	—	—	0x01 ~ 0x08	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x51	—	—	—	0x0A 0x0D

Clears Display	Parameter
Clears ALL	0x01
Clears ROW 1	0x02
Clears ROW 2	0x03

14. Contrast Setting

Description	This command adjusts the contrast of the LCD character display. The contrast level can be set within a range of 1 to 8, where 8 represents the highest contrast. This value will be stored in the internal EEPROM. The default setting is 3.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x52	—	—	0x01~0x08	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x52	—	—	0x08	0x0A 0x0D

15. Backlight Setting

Description	This command adjusts the backlight brightness level, with the selected value being saved to the internal EEPROM. The default setting is level 8.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x53	—	—	0x01~0x08	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x53	—	—	0x08	0x0A 0x0D

16. Set Custom Character 0x54 [ADDRESS] [DATA0 ... 7]

Description	This command used to generate custom character. The custom character pattern is bit mapped into 8 bytes, allowing for a total of eight customizable characters. To display custom characters, enter addresses 0-7. If the user wants to place the Spanish character '日' at the address 0x07, then send 0x1F 0x11 0x11 0x1F 0x11 0x11 0x1F 0x00						
Syntax	Start character	Command	Column	ROW	Parameter		End character
Example	0x00 0x00 0x00	0x54	0x00 ~ 0x0F	0x00 ~ 0x01	0x00 ~ 0x07	8 Byte	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x54	0x00	0x00	0x00	0x1F 0x11 0x11 0x1F 0x11 0x11 0x1F 0x00	0x0A 0x0D

CGRAM address: 0x00~0x07

Bit	7	6	5	4	3	2	1	0	HEX
Data0	0	0	0	1	1	1	1	1	0x1F
Data1	0	0	0	1	0	0	0	1	0x11
Data2	0	0	0	1	0	0	0	1	0x11
Data3	0	0	0	1	1	1	1	1	0x1F
Data4	0	0	0	1	0	0	0	1	0x11
Data5	0	0	0	1	0	0	0	1	0x11
Data6	0	0	0	1	1	1	1	1	0x1F
Data7	0	0	0	0	0	0	0	0	0x00

17. Shift Display Left

Description	This command shifts the display to the left 1 space. The cursor position also moves with the display, and the displayed text is not altered.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x55	—	—	—	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x55	—	—	—	0x0A 0x0D

18. Shift Display Right

Description	This command shifts the display to the right 1 space. The cursor position also moves with the display, and the displayed text is not altered.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x56	—	—	—	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x56	—	—	—	0x0A 0x0D



19. Change Baud Rate

Description	This command is used to set the UART baud rate, with the default value being 4 (means 9600bps). The single-byte parameter selects the desired baud rate as indicated in the table below. The newly set baud rate takes 28 microseconds to become effective; hence, subsequent inputs must consider an appropriate delay. The set baud rate value is stored in the internal EEPROM. Any illegal parameter inputs will be disregarded.					
Syntax	Start character	Command	Column	ROW	Parameter	End character
Example	0x00 0x00 0x00	0x61	—	—	0x03~0x08	0x0A 0x0D
hexadecimal	0x00 0x00 0x00	0x61	—	—	0x08	0x0A 0x0D

Baud Rate	Parameter
4800bps	0x03
9600bps	0x04
14400bps	0x05
19200bps	0x06
57600bps	0x07
115200bps	0x08