



ASI-A-19212F-AB-GWD/U

Item	Contents	Unit
LCD type	FSTN NEGATIVE	-
Viewing direction	6:00	O'Clock
Module size (W×H×T)	50.30×39.40×4.40 (excluded FPC length)	mm
Viewing area (W×H)	44.00×29.00	mm
Driver IC	UC1638	-
Number of dots	192X128	-
Backlight type	2 LEDS White 3.0V 30mA	-
Interface type	Serial interface	-
Operating temperature	-20 ~ 70	°C
Storage temperature	-30 ~ 80	°C

REVISION HISTORY:				
Revision	Date	Description	Written By	Approved By
1.0	2017-05-19			

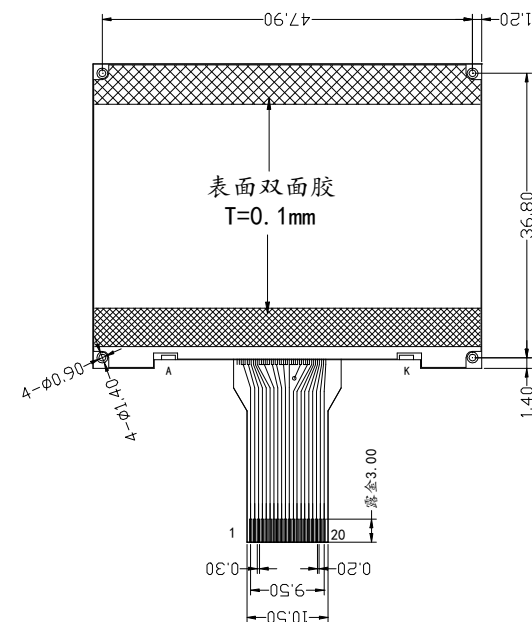
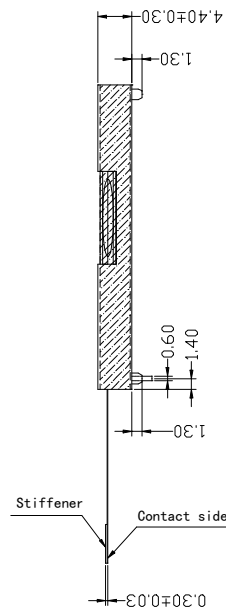
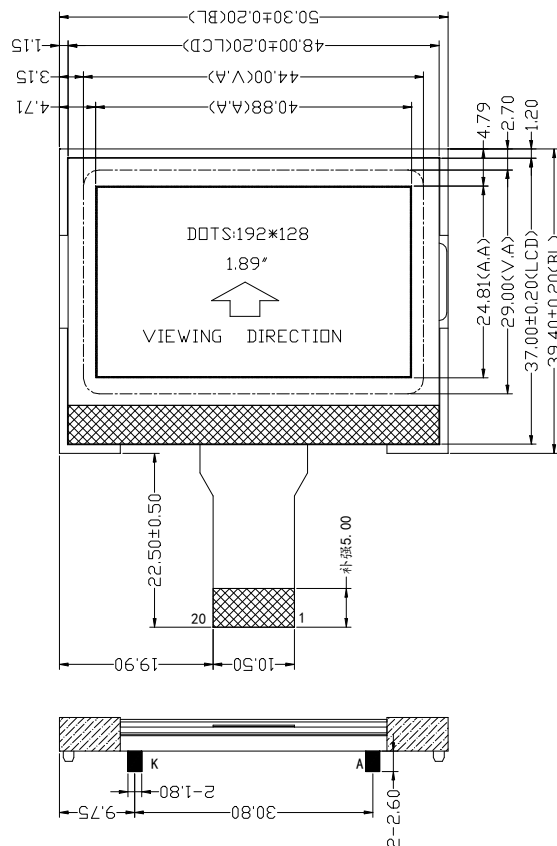
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1.0 GENERAL SPECIFICATION

Item	Contents	Unit
LCD type	FSTN NEGATIVE	-
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Interface type	Serial interface	-
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Storage temperature	-30 ~ 80	°C

2.0 OUTLINE DRAWING

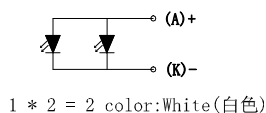


No	Name
1	SDA
2	VSS
3	SCK
4	RST
5	CSO
6	CD/A0
7	VSS
8	ID
9	POR-DIS
10	VSS
11	VDD
12	VLCD
13	VA0-
14	VA1-
15	VA1+
16	VA0+
17	VB0-
18	VB1-
19	VB1+
20	VB0+

NOTES:

- 1.DISPLAY TYPE: FSTN, transmissive
- 2.POLARIZER:
- 3.VIEWING DIRECTION: 6:00-CLOCK
- 4.DRIVE METHOD: 1/128DUTY,1/12BIAS
- 5.OPERATING VOLTAGE: 3.0V OR 3.3V
- 6.OPERATING TEMP: -20°C TO 70 °C
- 7.STORAGE TEMP: -30°C TO 80 °C
- 8.DRIVE: UC1638C
- 9.UNSIGNED TOLERANCE: ±0.20
- 10.LED BACKLIGHT: WHITE
- 11.LED BACKLIGHT OPERATING VOLTAGE: 3.0V
- 12.LED BACKLIGHT OPERATING ELECTRIC CURRENT: ≤30mA

LED CIRCUIT DIAGRAM:

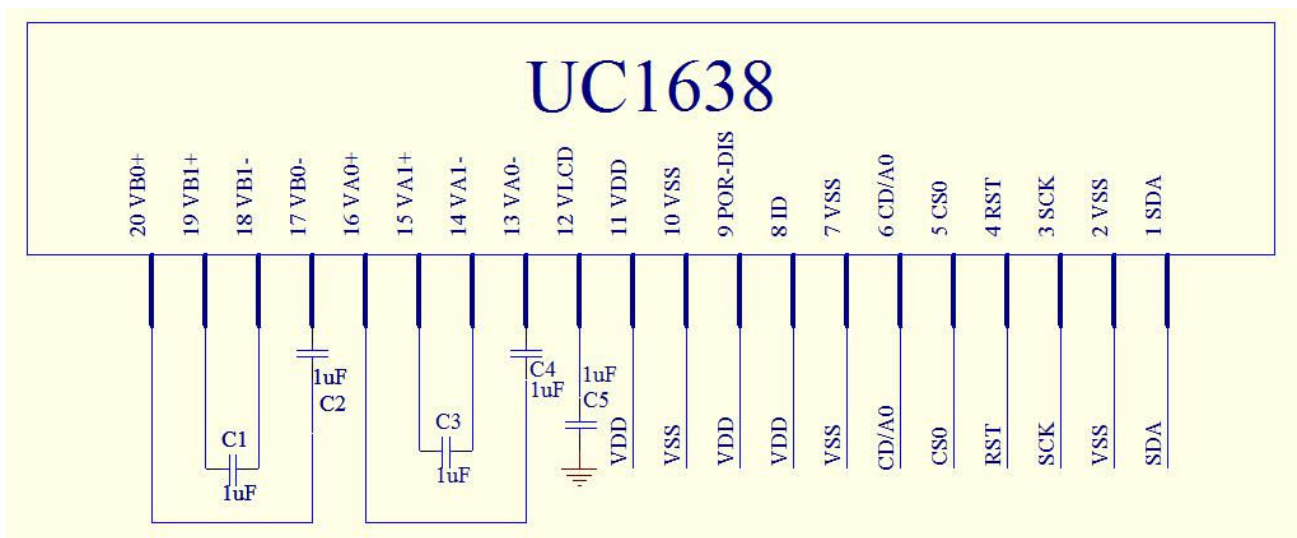
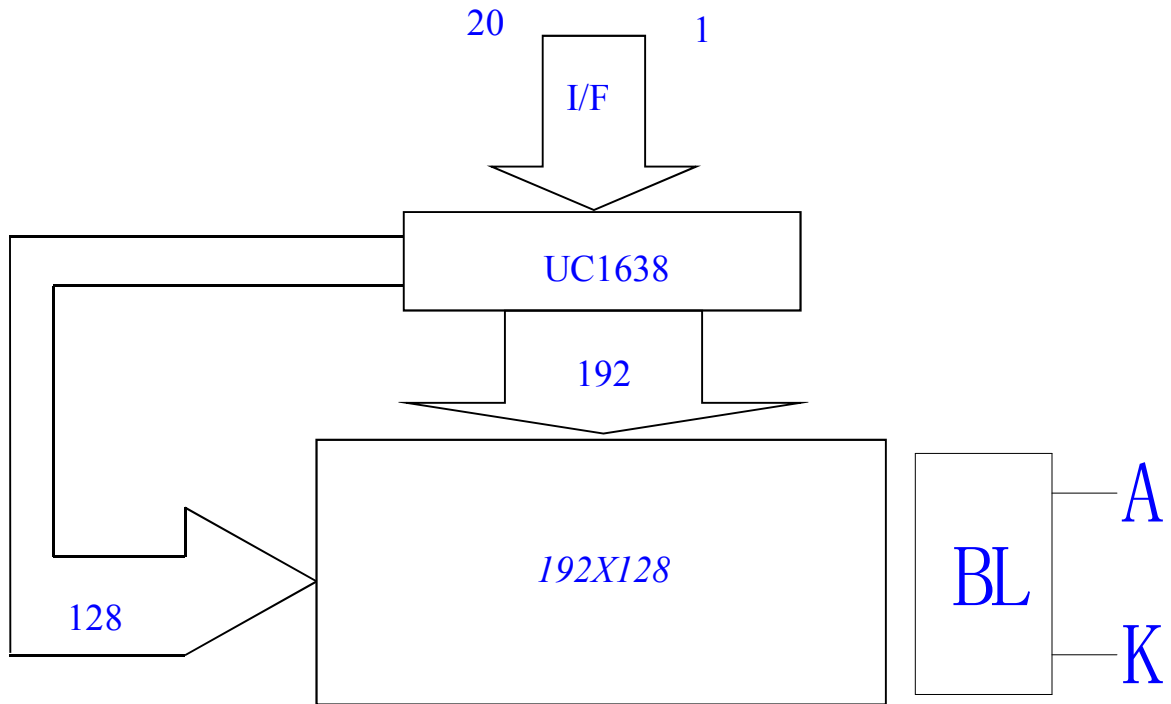


SHEET: 1 OF 1			
GENERAL TOL. 0.20MM	UNITS MM		
APPROVALS		DATE	MODEL NUMBER :
DRAFTED	WL	07/02	ASI-A-19212F-AB-GWD/U
CHECKED	TU	07/02	
APPROVED	TU	07/02	
		PROJECTION	DATE: 2018-02-07

3.0 INTERFACE PIN DESCRIPTION

Pin No.	Symbol	Pin Description
1	SDA	Serial data input
2	VSS	Ground
3	SCK	Serial clock input
4	RST	A reset pin.
5	CS0	Chip select signal input(low active)
6	CD/A0	Data or command select signal input
7	VSS	Ground
8	ID	ID pin is for production control
9	POR-DIS	Power-ON reset control
10	VSS	Ground
11	VDD	Power supply (+3.0)
12	VLCD	High voltage LCD Power Supply
13	VA0-	LCD Bias Voltages
14	VA1-	LCD Bias Voltages
15	VA1+	LCD Bias Voltages
16	VA0+	LCD Bias Voltages
17	VB0-	LCD Bias Voltages
18	VB1-	LCD Bias Voltages
19	VB1+	LCD Bias Voltages
20	VB0+	LCD Bias Voltages

4.0 BLOCK DIAGRAM



5.0 OPERATING PRINCIPLE & DRIVING METHOD

The following is a list of host commands supported by UC1638c:

C/D: 0: Control, 1: Data **W/R**: 0: Write Cycle, 1: Read Cycle **D7-D0**: # : Useful Data bits —: Don't Care

No	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Default	
1.	Write Data Byte (multiple-byte command)	0	0	0	0	0	0	0	0	0	1	Write byte by byte	N/A	
		1	0	#	#	#	#	#	#	#	#			#
		:	:	:	:	:	:	:	:	:	:			:
2.	Read Data Byte (multiple-byte command)	0	0	0	0	0	0	0	0	1	0	Read byte by byte	N/A	
		1	1	#	#	#	#	#	#	#	#			#
		:	:	:	:	:	:	:	:	:	:			:
3.	Get Status (triple-byte command)	0	0	0	0	0	0	0	0	1	1	Get Status	N/A	
		1	1	POR	MX	MY	PID	DE	WS	MD	MS			
		1	1	Ver1:0			PMO[5:0]							
4.	Set Column Address (double-byte command)	0	0	0	0	0	0	0	1	0	0	Set CA[7:0]	00H	
		1	0	#	#	#	#	#	#	#	#			
5.	Set Temp. Compensation	0	0	0	0	1	0	0	#	#	#	Set TC[2:0]	100b	
6.	Set Pump Control	0	0	0	0	1	0	1	1	0	#	Set PC	1b	
7.	Set Adv. Program Control (double-byte command)	0	0	0	0	1	1	0	R	R	R	R = 0~5, Set APC[R][7:0]	N/A	
		1	0	#	#	#	#	#	#	#	#			
8.	Set Scroll Line LSB Set Scroll Line MSB	0	0	0	1	0	0	#	#	#	#	Set SL[3:0]	0H	
		0	0	0	1	0	1	#	#	#	#	Set SL[7:4]	0H	
9.	Set Page Address LSB Set Page Address MSB	0	0	0	1	1	0	#	#	#	#	Set PA[3:0]	0H	
		0	0	0	1	1	1	0	0	#	#	Set PA[5:4]	0H	
10.	Set VBIAS Potentiometer (double-byte command)	0	0	1	0	0	0	0	0	0	1	Set PM[7:0]	54H	
		1	0	#	#	#	#	#	#	#	#			
11.	Set Partial Display Control	0	0	1	0	0	0	0	1	0	#	Set LC[8]	0: Disable	
12.	Set COM Scan Function	0	0	1	0	0	0	0	1	1	#	Set CSF	0b	
13.	Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]	001b	
14.	Set Display mode	0	0	1	0	0	1	0	1	#	#	Set DC[5:4]	00b	
15.	Set Line Rate	0	0	1	0	1	0	0	0	#	#	Set LC[3:2]	10b	
16.	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]	0b	
17.	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]	0b	
18.	Set LCD Mapping Control	0	0	1	1	0	0	0	#	#	0	Set LC[1:0]	00b	
19.	Set N-Line Inversion (double-byte command)	0	0	1	1	0	0	1	0	0	0	Set NIV[6:0]	00H	
		1	0	0	#	#	#	#	#	#	#			
20.	Set Display Enable (double-byte command)	0	0	1	1	0	0	1	0	0	1	Set DC[3:2]	10b	
		1	0	1	0	1	0	1	1	#	#			
21.	Set LCD Gray Shade 1	0	0	1	1	0	1	0	0	#	#	Set LC[5:4]	01b	
22.	Set LCD Gray Shade 2	0	0	1	1	0	1	0	1	#	#	Set LC[7:6]	10b	
23.	System Reset (double-byte command)	0	0	1	1	1	0	0	0	0	1	System Reset	N/A	
		1	0	1	1	1	0	0	0	1	0			
24.	NOP	0	0	1	1	1	0	0	0	1	1	No operation	N/A	
25.	Set Test Control (double-byte command)	0	0	1	1	1	0	0	1	TT		For testing only. Do not use.	N/A	
		1	0	#	#	#	#	#	#	#	#			
26.	Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]	11b: 12	
27.	Reset Cursor Update Mode	0	0	1	1	1	0	1	1	1	0	AC[4]=0, CA=CR	N/A	
28.	Set Cursor Update Mode	0	0	1	1	1	0	1	1	1	1	AC[4]=1, CR=CA	N/A	
29.	Set COM End (double-byte command)	0	0	1	1	1	1	0	0	0	1	Set CEN[7:0]	159	
		1	0	#	#	#	#	#	#	#	#			
30.	Set Partial Display Start (double-byte command)	0	0	1	1	1	1	0	0	1	0	Set DST[7:0]	0	
		1	0	#	#	#	#	#	#	#	#			
31.	Set Partial Display End (double-byte command)	0	0	1	1	1	1	0	0	1	1	Set DEN[7:0]	159	
		1	0	#	#	#	#	#	#	#	#			

No	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Default
32.	Set Window Programming Starting Column Address	0	0	1	1	1	1	0	1	0	0	Set WPC0[7:0]	0
		1	0	#	#	#	#	#	#	#	#		
33.	Set Window Programming Starting Page Address	0	0	1	1	1	1	0	1	0	1	Set WPP0[5:0]	0
		1	0	0	0	#	#	#	#	#	#		
34.	Set Window Programming Ending Column Address	0	0	1	1	1	1	0	1	1	0	Set WPC1[7:0]	239
		1	0	#	#	#	#	#	#	#	#		
35.	Set Window Programming Ending Page Address	0	0	1	1	1	1	0	1	1	1	Set WPP1[5:0]	39
		1	0	0	0	#	#	#	#	#	#		
36.	Enable Window Program	0	0	1	1	1	1	1	0	0	#	Set AC[3]	0: Disable
37.	Set MTP Operation control (double-byte command)	0	0	1	0	1	1	1	0	0	0	Set MTPC[4:0]	10H
		1	0	0	0	0	#	#	#	#	#		
38.	Set MTP Write Mask (double-byte command)	0	0	1	0	1	1	1	0	0	1	Set MTPM[5:0]	00H
		1	0	0	0	#	#	#	#	#	#		
39.	Set MTP Read Potentiometer	0	0	1	1	1	1	1	0	1	0	Set RV[7:0] (BR=00b)	00H
		1	0	#	#	#	#	#	#	#	#		
40.	Set MTP Program/Erase Potentiometer	0	0	1	1	1	1	1	0	1	1	Set WV[7:0] (BR=10b)	46H
		1	0	#	#	#	#	#	#	#	#		
41.	Set MTP Write Timer (double-byte command)	0	0	1	1	1	1	1	1	0	0	Set WT[7:0]	40H
		1	0	#	#	#	#	#	#	#	#		
42.	Set MTP Read Timer (double-byte command)	0	0	1	1	1	1	1	1	0	1	Set RT[7:0]	03H
		1	0	#	#	#	#	#	#	#	#		

Warning: Any bit patterns other than the commands listed above may result in undefined behavior.

Notes:

- (1) Any bit patterns other than the commands listed above may result in undefined behavior.
- (2) The interpretation of commands (37)~(42) depends on register MTPC[3].
- (3) After MTP-ERASE or MTP-PROGRAM operation, before resuming normal operation, please always
 - a) Remove TST4 power source,
 - b) Do a full VDD ON-OFF-ON cycle.

6.0 ABSOLUTE MAXIMUM RATINGS (Ta = 25°C, V_{SS} = 0 V)

Symbol	Parameter	Min.	Max.	Unit
V _{DD}	Logic Supply voltage	-0.3	+4.0	V
V _{DD2}	LCD Generator Supply voltage	-0.3	+4.0	V
V _{DD3}	Analog Circuit Supply voltage	-0.3	+4.0	V
V _{DD2/3} -V _{DD}	Voltage difference between V _{DD} and V _{DD2/3}	--	1.6	V
V _{LCD}	LCD Generated voltage (-40°C ~ +85°C)	-0.3	+19.8	V
V _{IN}	Digital input signal	-0.4	V _{DD} + 0.5	V
T _{OPR}	Operating temperature range	-40	+85	°C
T _{STR}	Storage temperature	-55	+125	°C

Note:

1. V_{DD} is based on V_{SS} = 0V
2. Stress beyond ranges listed above may cause permanent damages to the device.

7.0 ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{DD}	Supply for digital circuit		1.7	1.8~3.3	3.6	V
$V_{DD2/3}$	Supply for bias & pump		2.7	2.8~3.3	3.6	V
V_{LCD}	Charge pump output	$V_{DD2/3} \geq 2.7V, 25^{\circ}C$		14.5	17.49	V
V_D	LCD data voltage	$V_{DD2/3} \geq 2.7V, 25^{\circ}C$	0.99		1.59	V
V_{IL}	Input logic LOW				$0.2V_{DD}$	V
V_{IH}	Input logic HIGH		$0.8V_{DD}$			V
V_{OL}	Output logic LOW				$0.2V_{DD}$	V
V_{OH}	Output logic HIGH		$0.8V_{DD}$			V
I_{IL}	Input leakage current	$V_{IN} = V_{DD} \text{ or } V_{SS}$			1.5	μA
I_{SB}	Standby current	$V_{DD} = V_{DD2/3} = 3.3V$, Temp = $85^{\circ}C$			50	μA
C_{IN}	Input capacitance			5	10	pF
C_{OUT}	Output capacitance			5	10	pF
$R_{ON(SEG)}$	SEG output impedance	$V_{LCD} = 17.49V$		1.20	1.70	k Ω
$R_{ON(COM)}$	Upward COM output impedance	$V_{LCD} = 17.49V$		1.20	1.70	k Ω
f_{LINE}	Average Line rate	LC[4:3] = 10b	-10%	26.0	+10%	kips

POWER CONSUMPTION

$V_{DD} = 2.7V$,
 $V_{LCD} = 14.51V$,
 Bus mode = 6800,
 Temperature = $25^{\circ}C$,

Bias Ratio = 11b,
 Line Rate = 26 Kips,
 $C_L = 330nF$,
 All HV outputs are open circuit.

PM = 84,
 Mux Rate = 160
 $C_B = 2.2\mu F$,

Display Pattern	Conditions	Typical	Maximum	Unit
All-OFF	Bus = idle	1173	1467	μA
All-ON	Bus = idle	1205	1507	μA
2-pixel checker	Bus = idle	1445	1807	μA
-	Reset (standby current)	< 3	5	μA

8.0 ELECTRO-OPTICAL CHARACTERISTICS

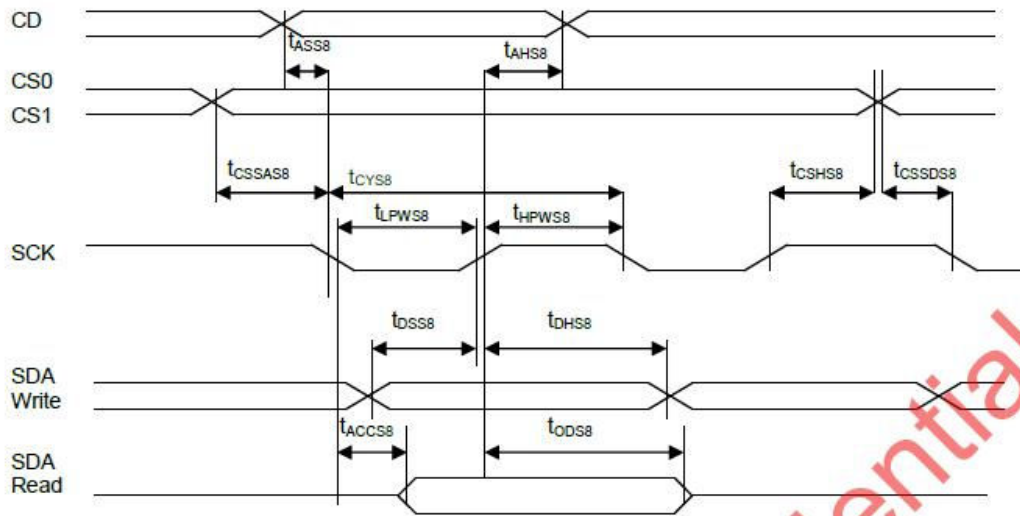


FIGURE 18: Serial Bus Timing Characteristics (for S8)

Symbol	Signal	Description	Condition	Min.	Max.	Unit
(2.7V $\leq$ V _{DD} $\leq$ 3.6V, Ta = -30 to +85°C)						
t_{ASS8}	CD	Address setup time	(read / write)	0	—	nS
t_{AHS8}		Address hold time		15	—	nS
t_{CSSAS8}	CS1/CS0	Chip select setup time		5	—	nS
t_{CHS8}		Chip select hold time		15	—	nS
t_{CYS8}	SCK	System cycle time		430 / 220	—	nS
t_{LPWS8}		Low pulse width		200 / 95	—	nS
t_{HPWS8}		High pulse width		200 / 95	—	nS
t_{DSS8}	SDA (Write)	Data setup time		— / 25	—	nS
t_{DHS8}		Data hold time		— / 15	—	nS
t_{ACCS8}	SDA (Read)	Read access time	C _L = 100pF	— / —	200	nS
t_{ODS8}		Output disable time		30 / —	—	nS

Note: tr (rising time), tf (falling time) : $\leq$ 15nS

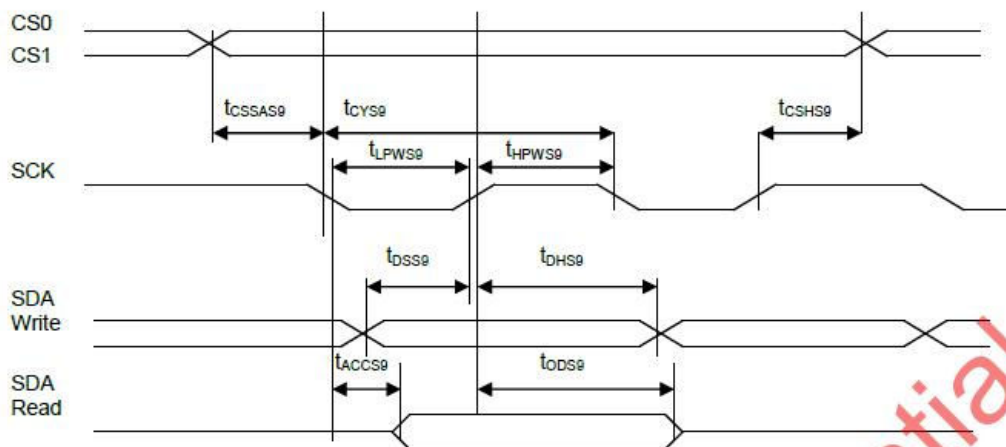


FIGURE 19: Serial Bus Timing Characteristics (for S9)

Symbol	Signal	Description	Condition	Min.	Max.	Unit
(2.7V ≤ V _{DD} ≤ 3.6V, Ta = -30 to +85°C)				(read / write)		
t _{CSSAS9}	CS1/CS0	Chip select setup time		5	—	nS
t _{CSSHS9}		Chip select hold time		15		
t _{CYS9}	SCK	System cycle time		430 / 220	—	nS
t _{LPWS9}		Low pulse width		200 / 95		
t _{HPWS9}		High pulse width		200 / 95		
t _{DSS9}	SDA (Write)	Data setup time		— / 25	—	nS
t _{DHS9}		Data hold time		— / 15		
t _{ACCS9}	SDA (Read)	Read access time	C _L = 100pF	— / —	200	nS
t _{ODS9}		Output disable time		30 / —		

Note: tr (rising time), tf (falling time) : ≤ 15nS

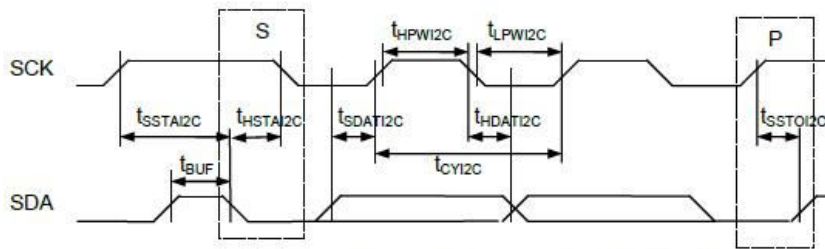


FIGURE 20: Serial Bus Timing Characteristics (for I²C)

Symbol	Signal	Description	Condition	Min.	Max.	Unit
(2.7V ≤ V _{DD} ≤ 3.6V, Ta = -30 to +85°C)				(Read / Write)		
t _{CYI2C}	SCK	SCK cycle time		530 / 230	–	nS
t _{LPWI2C}		Low pulse width		250 / 100	–	nS
t _{HPWI2C}		High pulse width		250 / 100	–	nS
t _r , t _f	SCK SDA	Rise time and fall time		–	–	nS
t _{SSDAI2C}		Data setup time		55	–	nS
t _{HDAI2C}		Data hold time		10	–	nS
t _{SSTAI2C}		START Setup time		10	–	nS
t _{HSTAI2C}		START Hold time		55	–	nS
t _{SSTOI2C}		STOP setup time		10	–	nS
t _{BUF}		Bus Free time between STOP and START condition		75	–	nS

Note: t_r (rising time), t_f (falling time) : ≤ 15nS

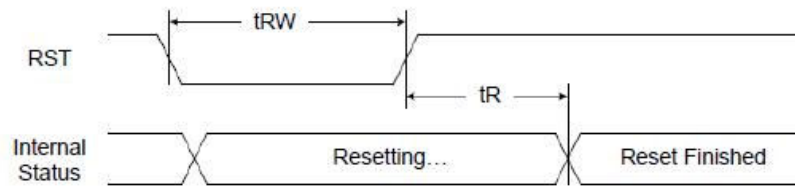
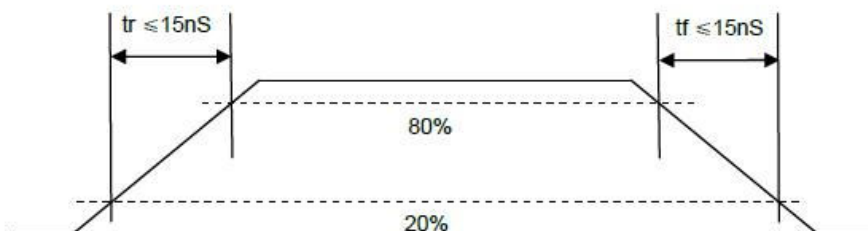


FIGURE 21: Reset Characteristics

Symbol	Signal	Description	Condition	Min.	Max.	Unit
(2.7V ≤ V _{DD} ≤ 3.6V, Ta = -30 to +85°C)						
t _{RW}	RST	Reset low pulse width		5	—	mS
t _R	RST, Internal Status	Reset to Internal Status pulse delay		10	—	uS
		Wait before Power Down		1	—	mS

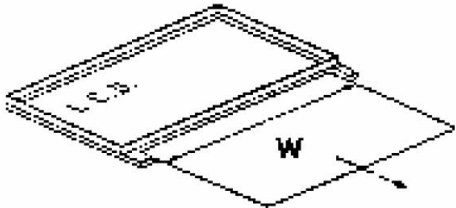
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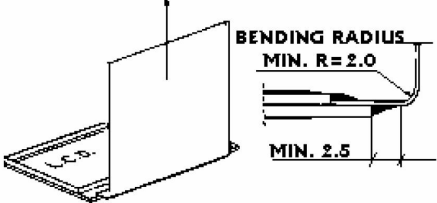
For each mode, the signal's rising and falling times (tr, tf) are stipulated to be equal to or less than 15nS each.



9.0 STANDARD SPECIFICATION FOR RELIABILITY

9.1 Standard specification of Reliability Test

No.	Test Item	Content of Test	Test Condition
1	High temperature operation	Endurance test applying the high storage temperature for a long time.	+70°C for 500Hrs
2	Low temperature operation	Endurance test applying the low storage temperature for a long time.	-20°C for 500Hrs
3	Low temperature storage	Endurance test applying the low storage temperature for a long time.	-30 °C for 500hrs
4	High temperature storage	Endurance test applying the low storage temperature for a long time.	+80 °C for 500hrs
5	Damp heat Operation	Endurance test applying the electric stress and temperature / humidity stress to the element for a long time.	+60 °C, 95%RH for 500Hrs
6	Thermal cycles operation	Endurance test applying the thermal shock operation for a long time.	Display on , 2h at -30°C ; shift from - 30°C to + 80°C with gradient of 3°C/min; 2 h at 80°C; shift from +80°C to - 30°C with gradient of 2°C/min , repeated 100 times.
7	Thermal shocks	Endurance test applying the thermal shock operation for a long time.	Display off, 1h at -30°C ; shift from - 30°C to + 80°C in 10 s max. 1 h at 80°C; shift from + 80°C to - 30°C in 10 s max. , repeated 100 times
8	Random vibrations	Endurance test applying the vibrations. for a long time when transportation	Test 3 axes during 8 hour/axe - from 5 to 200 Hz: Acc = 10G - from 200 to 500 Hz : Amplitude =5mm – from 5 to 12HZ. Scanning speed= 1 octave / min
9	ESD test	To check the immunity of display to ESD incurred during storage, handling, maintenance and assembly operation.	Discharge resistance = 2kΩ Discharge capacitance = 150pF Number of discharges = 3times Discharge interval = 3 sec Discharge voltage = ± 2 kV on COG connection interface.
10	FPC pull test	To verify the FPC/ glass connection resistance to pull forces applied to the FPC.	 Keeping the LCD fixed, pull the FPC/FFC with a force F= 40 N for cm width of FPC at glass connection.

11	FPC peel test	To verify the FPC/ glass connection resistance to peel forces applied to the FPC.	 Keeping the LCD fixed, pull the FPC/FFC according to the figure above with a force $F = 10\text{ N}$ for cm width of FPC at glass connection. The minimum bending radius has to be 2 mm
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Remarks:

- 1) For operation test, above specification is applicable when test pattern is changing during entire operation test.
- 2) Inspections after reliability tests are performed when the display temperature resumes back to room temperature.
- 3) It is a normal characteristic that some display abnormality can be seen during reliability test. If the display abnormality can resume back to normal condition at room temperature within 24hours, there is no permanent destruction over the display. The display still possesses its functionality after reliability tests.

9.2 Failure Judgment Criteria

After the reliability tests above, test sample shall be let return to room temperature and humidity for at least 4 hours before final tests are carried out.

Criterion Item	Failure Judgment Criteria
Electrical characteristic	Electrical short and open.
Mechanical characteristic	Out of mechanical specification
Optical characteristic	Out of the Appearance Standard

10.0 QUALITY ASSURANCE

10.1 Inspection Standard

Item	Contents
Objective	This product inspection standard is intended to provide an inspection guideline for the LCD or LCM products manufactured by the Company.
Scope	Applicable to the inspection criteria of dimension, appearance, functionality etc.for the LCD or LCM products supplied to the customer. Criteria not included in this Inspection Standard will be justified in accordance with any documents agreed upon otherwise.
Inspection Unit	An inspection unit is a unit of display under inspection. The unit for the dimension addressed in this inspection standard is referring to mm, unless otherwise specified.
Inspection System	1 : Inspection system includes inspection during production inspection and outgoing product inspection. 2: Process inspection is the inspection for appearance and functionality of the products during the production process. 3: Outgoing inspection is the inspection for the finished products prior to the delivery, based on defined sampling plan.

Inspection Condition

1 : Inspection equipments: Equipment and tools used for inspection, measuring and testing during the inspection process.

2: Inspection conditions are described as the following.

Distance: 40cm between the observer's eyes and the LCD.

Viewing angle: according to main viewing direction (MVD) .

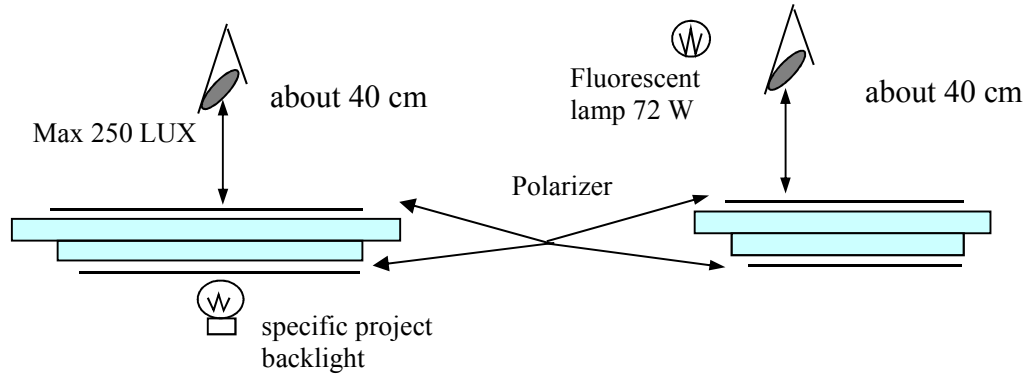


Fig 1
Trasflective or Transmissive LCD/LCM

Fig 2
Reflective LCD/LCM

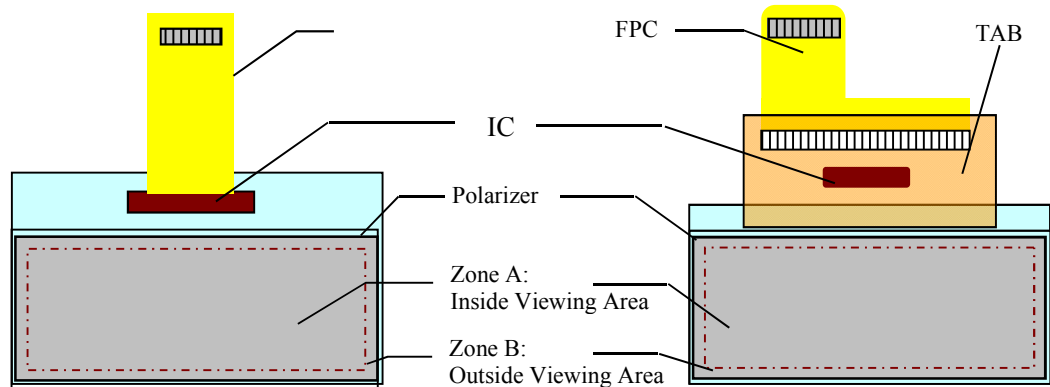
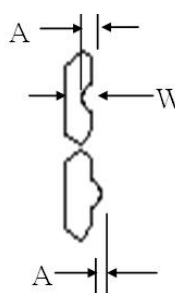
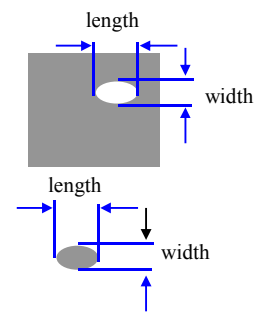
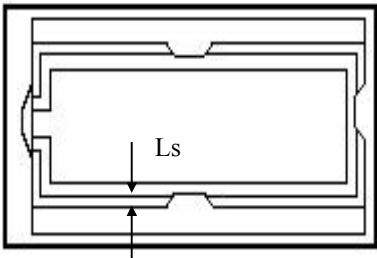
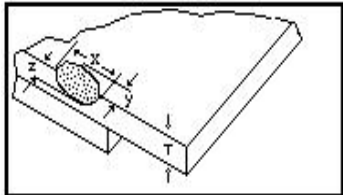
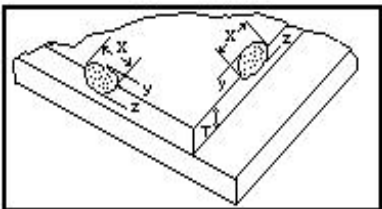
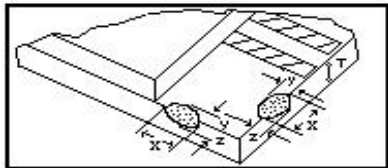
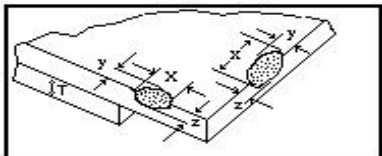
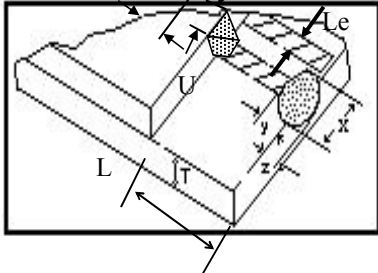
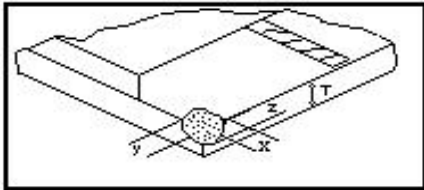
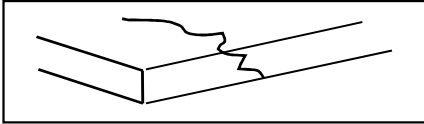


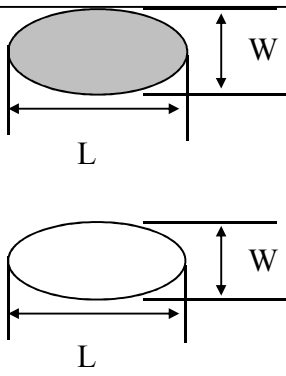
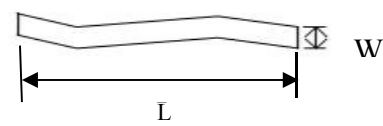
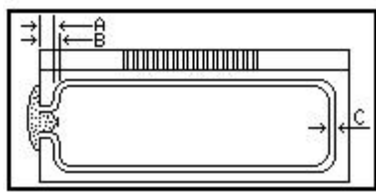
Fig 3
Product Configuration

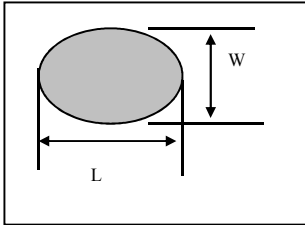
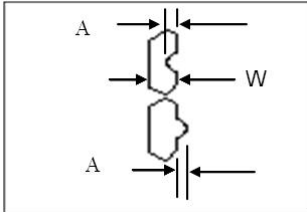
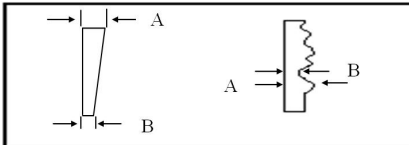
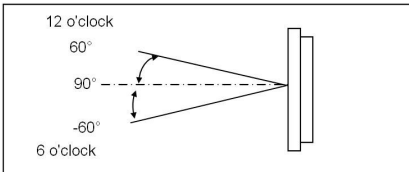
10.2 Acceptance Criteria

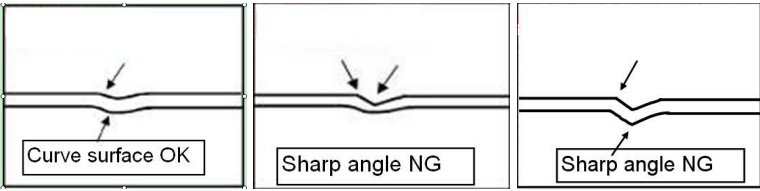
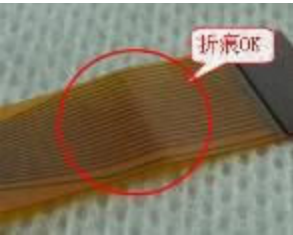
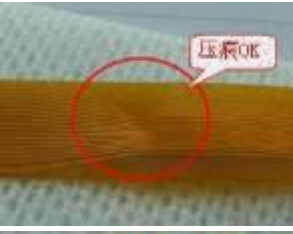
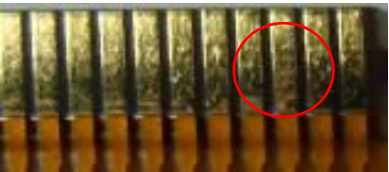
Inspection Item	Acceptance/Rejection Criteria	Defect Classification	Method	Applicable Zone								
Functional	1. No display defect is not acceptable. 2. Abnormal display defect is not acceptable. 3. Missing segment and extra segment is not acceptable. 4. Dim contrast or dark contrast is not acceptable. 5. Current consumption (Idd MAX) shall not exceed the limit specified on the MI. 6. Wrong/reversed viewing angle is not acceptable. 7. Uneven contrast or stripe defect shall be in accordance with master sample. (Refer to specified limit sample if applicable) 8. Display character/ pattern shall be referred to the Test Instruction of the related models.	Major	Visual	A								
Pattern Deformation	 <table border="1"> <tr> <th>Size</th> <th>Acceptable Number</th> </tr> <tr> <td>$A \leq 0.10$ or $A \leq 1/4W$, whichever is less</td> <td>1 per segment 3 per display</td> </tr> <tr> <td>$A > 0.10$ or $A > 1/4W$, whichever is less</td> <td>Unlimited</td> </tr> </table> Note: Protrusion shall not cause bridging between adjacent segments	Size	Acceptable Number	$A \leq 0.10$ or $A \leq 1/4W$, whichever is less	1 per segment 3 per display	$A > 0.10$ or $A > 1/4W$, whichever is less	Unlimited	Major	Visual Magnifier	A		
Size	Acceptable Number											
$A \leq 0.10$ or $A \leq 1/4W$, whichever is less	1 per segment 3 per display											
$A > 0.10$ or $A > 1/4W$, whichever is less	Unlimited											
Black or white spots (on pattern), pin hole	 <table border="1"> <tr> <th>Size, d (mm)</th> <th>Acceptable quantity</th> </tr> <tr> <td>$d \leq 0.15$</td> <td>Unlimited</td> </tr> <tr> <td>$0.15 < d \leq 0.25$</td> <td>1</td> </tr> <tr> <td>$d > 0.25$</td> <td>0</td> </tr> </table> $d = (\text{length} + \text{width}) / 2$ Note: Number of spot shall not be more than 1 per each segment. If 2 spots exist, the distance must be > 20mm between each other	Size, d (mm)	Acceptable quantity	$d \leq 0.15$	Unlimited	$0.15 < d \leq 0.25$	1	$d > 0.25$	0	Minor	Visual Magnifier	A
Size, d (mm)	Acceptable quantity											
$d \leq 0.15$	Unlimited											
$0.15 < d \leq 0.25$	1											
$d > 0.25$	0											

Chip-out	A. General chip-out (for glass edges and glass corner along perimeter seal)  <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤2.0</td><td>≤1.5 or ≤Ls, whichever is less</td><td>≤1/2t</td></tr><tr><td>≤2.0</td><td>≤1.0 or ≤Ls, whichever is less</td><td>≤t</td></tr></table> X = length parallel with glass edge. Y = width perpendicular with glass edge Z = height of glass t = single glass thickness Note: Chip out shall not reach the perimeter seal.	X	Y	Z	≤2.0	≤1.5 or ≤Ls, whichever is less	≤1/2t	≤2.0	≤1.0 or ≤Ls, whichever is less	≤t	Minor	Visual Magnifier	B
X	Y	Z											
≤2.0	≤1.5 or ≤Ls, whichever is less	≤1/2t											
≤2.0	≤1.0 or ≤Ls, whichever is less	≤t											
	B: Chip-out at terminal ledge or back of terminal ledge, but no exactly on terminal  <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤2.0</td><td>≤1.5</td><td>≤1/2t</td></tr><tr><td>≤2.0</td><td>≤1.0</td><td>≤t</td></tr></table> Note: In the event that the distance between the chip-out location and the terminal is less than the width of ITO pad Le, the acceptance criteria of chip-out on terminal shall apply.	X	Y	Z	≤2.0	≤1.5	≤1/2t	≤2.0	≤1.0	≤t	Minor	Visual Magnifier	B
X	Y	Z											
≤2.0	≤1.5	≤1/2t											
≤2.0	≤1.0	≤t											

	C: Chip-out and protuberance at terminals  <table><tr><td>W</td><td>U</td></tr><tr><td colspan="2">Meet the dimension tolerance of the drawing</td></tr></table> <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤0.5 Le & not bridge two adjacent ITO pads.</td><td>≤0.2L or ≤2.0mm whichever is less</td><td>≤1/2t</td></tr></table> Note: Chip out and protuberance shall not co-exist on the same ITO pad. Protuberance is not allowed if affect assembly.	W	U	Meet the dimension tolerance of the drawing		X	Y	Z	≤0.5 Le & not bridge two adjacent ITO pads.	≤0.2L or ≤2.0mm whichever is less	≤1/2t	Minor	Visual Magnifier	B
W	U													
Meet the dimension tolerance of the drawing														
X	Y	Z												
≤0.5 Le & not bridge two adjacent ITO pads.	≤0.2L or ≤2.0mm whichever is less	≤1/2t												
	D: Chip-out at corner (ITO ledge)  <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤2.0</td><td>≤2.0</td><td>≤t</td></tr></table>	X	Y	Z	≤2.0	≤2.0	≤t	Minor	Visual Magnifier	B				
X	Y	Z												
≤2.0	≤2.0	≤t												
Crack line	 Crack line is not acceptable.	Minor	Visual Magnifier	A & B										
Number of Chip-out	Maximum acceptable number of chip-out: 2 defects per LCD; 1 defect on ITO ledge. Distance between chip-out: > 5mm.	Minor	Visual	B										

Black spot White spot Bubble Foreign material Dent	 <table><tr><th>D</th><th>Acceptable Number</th></tr><tr><td>$D \leq 0.15$</td><td>Unlimited</td></tr><tr><td>$0.15 < D \leq 0.25$</td><td>1</td></tr><tr><td>$D > 0.25$</td><td>0</td></tr></table> Note: If 2 spots exist, the distance must be > 20mm between each other $D = (L + W) / 2$	D	Acceptable Number	$D \leq 0.15$	Unlimited	$0.15 < D \leq 0.25$	1	$D > 0.25$	0	Minor	Visual Magnifier	A										
D	Acceptable Number																					
$D \leq 0.15$	Unlimited																					
$0.15 < D \leq 0.25$	1																					
$D > 0.25$	0																					
Scratch line Dark line Lint	 <table><tr><th>Length</th><th>Width</th><th>Acceptable Number</th></tr><tr><td>$L \leq 3.0$</td><td>$W \leq 0.015$</td><td>2</td></tr><tr><td>$L \leq 1.5$</td><td>$W \leq 0.03$</td><td>1</td></tr><tr><td></td><td>$W > 0.03$</td><td>0</td></tr></table> Note: If 2 line defects co-exist, the distance must be > 20mm between each other	Length	Width	Acceptable Number	$L \leq 3.0$	$W \leq 0.015$	2	$L \leq 1.5$	$W \leq 0.03$	1		$W > 0.03$	0	Minor	Visual Magnifier	A						
Length	Width	Acceptable Number																				
$L \leq 3.0$	$W \leq 0.015$	2																				
$L \leq 1.5$	$W \leq 0.03$	1																				
	$W > 0.03$	0																				
Endseal	 <table><tr><td>A: Length of end-sealant</td></tr><tr><td>B: Length of seal mouth</td></tr><tr><td>C: Perimeter seal width</td></tr></table> 1. Minimum amount of end-sealant filled, $A > 1/3 B$ 2. Maximum amount of end-sealant shall not spread over to Zone A, Viewing Area (VA). 3. Dimension of end seal shall meet the dimension specified on the drawing. 4. Deformation of perimeter seal which result in perimeter seal becoming less than $1/3 C$ is not acceptable.	A: Length of end-sealant	B: Length of seal mouth	C: Perimeter seal width	Minor	Visual Magnifier	A,B															
A: Length of end-sealant																						
B: Length of seal mouth																						
C: Perimeter seal width																						
Polarizer	Polarizer position shall meet the dimension tolerance indicated on the drawing	Minor	Visual	A,B																		
Background color	Background color shall not exceed the range of the limit sample. Obvious uneven coloration (rainbow) shall not be seen.	Minor	Visual	A																		
Ink printing	<table><tr><td>1. Pattern position on the display shall match the MI/drawing.</td><td>Major</td><td>Visual</td></tr><tr><td>2. Pattern appearance shall match the MI/drawing.</td><td>Major</td><td>Visual</td></tr><tr><td>3. Reverse printing is not acceptable.</td><td>Major</td><td>Visual</td></tr><tr><td>4. Printing color shall match the master sample.</td><td>Major</td><td>Visual</td></tr><tr><td>5. Insufficient ink, blur, missing pattern, broken pattern are not acceptable.</td><td>Major</td><td>Visual</td></tr><tr><td>6. Angle of the printed pattern, the dimension between the pattern and the glass edge shall meet the dimension on the drawing.</td><td>Major</td><td>Visual</td></tr></table>	1. Pattern position on the display shall match the MI/drawing.	Major	Visual	2. Pattern appearance shall match the MI/drawing.	Major	Visual	3. Reverse printing is not acceptable.	Major	Visual	4. Printing color shall match the master sample.	Major	Visual	5. Insufficient ink, blur, missing pattern, broken pattern are not acceptable.	Major	Visual	6. Angle of the printed pattern, the dimension between the pattern and the glass edge shall meet the dimension on the drawing.	Major	Visual			A
1. Pattern position on the display shall match the MI/drawing.	Major	Visual																				
2. Pattern appearance shall match the MI/drawing.	Major	Visual																				
3. Reverse printing is not acceptable.	Major	Visual																				
4. Printing color shall match the master sample.	Major	Visual																				
5. Insufficient ink, blur, missing pattern, broken pattern are not acceptable.	Major	Visual																				
6. Angle of the printed pattern, the dimension between the pattern and the glass edge shall meet the dimension on the drawing.	Major	Visual																				

	7. The printed patterns shall be free of stain, fingerprint and scratch.	Major	Visual Magnifier									
	8. Spot/pinhole on the pattern.  <table><tr><th>D</th><th>Acceptable Number</th></tr><tr><td>$D \leq 0.15$</td><td>Unlimited</td></tr><tr><td>$0.15 < D \leq 0.25$</td><td>1</td></tr><tr><td>$D > 0.25$</td><td>0</td></tr></table> Note: If 2 spots exist, the distance must be > 20mm between each other $D = (L + W) / 2$	D	Acceptable Number	$D \leq 0.15$	Unlimited	$0.15 < D \leq 0.25$	1	$D > 0.25$	0	Major	Visual	
D	Acceptable Number											
$D \leq 0.15$	Unlimited											
$0.15 < D \leq 0.25$	1											
$D > 0.25$	0											
	9. Ink pattern deformation  Protrusion ≤ 0.10 or $\leq 1/4W$, whichever is less, Indentation ≤ 0.10 or $\leq 1/4W$, whichever is less	Minor	Visual Magnifier	A								
	10. Ink line deformation  $A - B \leq 0.15$	Minor	Visual Magnifier	A								
	11. Pattern misalignment  Dimension must meet the requirement on the drawing For 12 o'clock viewing angle product, light leakage between 90° to 60° shall not be seen. For 6 o'clock viewing angle product, light leakage between 90° to -60° shall not be seen.	Minor	Visual	A								
HSC FPC FFC	1. The outer dimension shall meet the MI/drawing.	Minor	Visual	B								

	2. FPC、HSC、FFC、 shall not have folding/stress/dented mark with sharp angle on the surface.       			
	4. Scratch on FPC、HSC、FFC、TAB shall not damage the PI layer and the conductive traces.  			
	5. Goldfinger of FPC、TAB、FFC shall be free of solder.			
	6. Goldfinger of FPC、TAB、FFC shall be max 5% of area of oxidization and corrosion. 	Major	Visual	B

Stiffening tape	1. The tape sticking position shall meet the requirement on the MI/drawing.	Minor	Visual	B
Identity Label	2. Missing label/tape/marking is not acceptable.			
Identity marking	3. The format of identification (including date code and product code) shall meet the requirement (eg. label,color marking, inkjet printing) on the MI/drawing.			
Metal bezel	1. Dimension and specification shall meet the requirment on the MI/drawing.	Major		B
	2.The lock tab of bezel shall not have wrong bending orientation, missing tab, or crack.	Minor	Visual	B
	3.Bezel shall be free of rust, twist, deformation,finger print,oil stain and unknown contamination.	Minor		B

11.0 PRECAUTIONS FOR USING LCD MODULE

11.1 Handling Precautions

- 11.1.1 The display panel is made of glass and polarizer. Do not subject it to mechanical shock by dropping or impact which may cause chipping especially on the edges.
- 11.1.2 Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 11.1.3 If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with Isopropyl alcohol or ethyl alcohol. Avoid using solvents like acetone (ketene), water, toluene, ethanol to clean the polarizer surface.
- 11.1.4 Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.
- 11.1.5 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 11.1.6 Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion.
- 11.1.7 Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
- 11.1.8 NC terminal should be open. Do not connect anything.
- 11.1.9 If the logic circuit power is off, do not apply the input signals.
- 11.1.10 Avoid contacting oil and fats.
- 11.1.11 Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.
- 11.1.12 Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.

11.2 Electro-Static Discharge Control

- 11.2.1 Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.

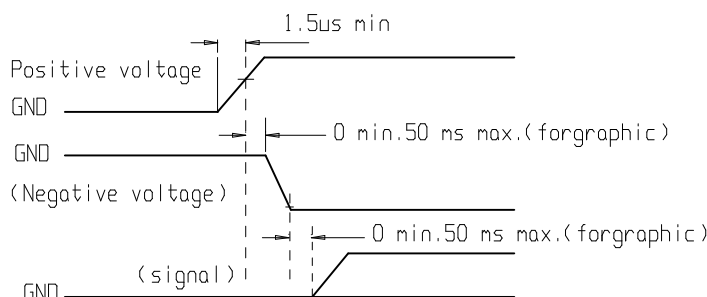
- 11.2.2 Be sure to ground the body when handling the LCD modules. Tools required for assembling, such as soldering irons, must be properly grounded.
- 11.2.3 To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity, be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.
- 11.2.4 The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- 11.2.5 When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.

11.3 Precaution for soldering to the LCM

- 11.3.1 Observe the following when soldering lead wire, connector cable and etc. to the LCD module.
- Soldering iron temperature: 300 ~ 350°C.
 - Soldering time: ≤ 3 sec.
 - Solder: eutectic solder.
- Above is a recommended approach based on a 5mm distance between soldering point and pin contact point. Due to different solder composition, actual distance between soldering and contact point, and processing method, it is recommended that customer to study and fine tuning their soldering process parameters accordingly so that the temperature at pin-LCD contact point does not exceed 85°C during soldering..
- 11.3.2 If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

11.4 Precautions for Operation

- 11.4.1 Viewing angle varies with the change of liquid crystal driving voltage (V_O). Adjust V_O to show the best contrast.
- 11.4.2 Driving the LCD in the voltage above the limit shortens its lifetime.
- 11.4.3 Response time is greatly delayed at temperature below the operating temperature range. However, it will recover when it returns to the specified temperature range.
- 11.4.4 If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
- 11.4.5 When turning the power on, input each signal after the positive/negative voltage becomes stable (below figure is a general illustration where typical value depends on individual product design).



11.5 Storage

- 11.5.1 When storing LCDs as spares for some years, the following precautions are necessary.
- Store them in a sealed polyethylene bag. If properly sealed, there is no need for desiccant.
 - Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.
- 11.5.2 Environmental conditions:
- Do not leave them for more than 168hrs. at 60°C.
 - Should not be left for more than 48hrs. at -20°C.

11.6 Safety

- 11.6.1 It is recommended to crush damaged or unnecessary LCD into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
- 11.6.2 If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.