

SAZENTO

DISPLAY CO.LTD

LIQUID CRYSTAL DISPLAY MODULE

Product Specification

CUSTOMER		
PRODUCT NUMBER	WCG12864B1FSDNBG	
CUSTOMER APPROVAL		Date 2008/3/20

INTERNAL APPROVALS			
Quality Mgr	Product Mgr	Mech. Eng	Electr. Eng
	Suny	Pat Chang	VANCEN

- ☐ Approval for Specification only
- ☒ Approval for Specification and Sample

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REVISION STATUS

Version	Revise Date	Page	Content	Modified by
V1.0	2007.12.14		First Issued	Iris

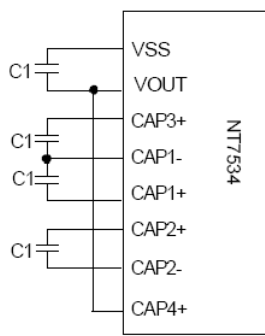
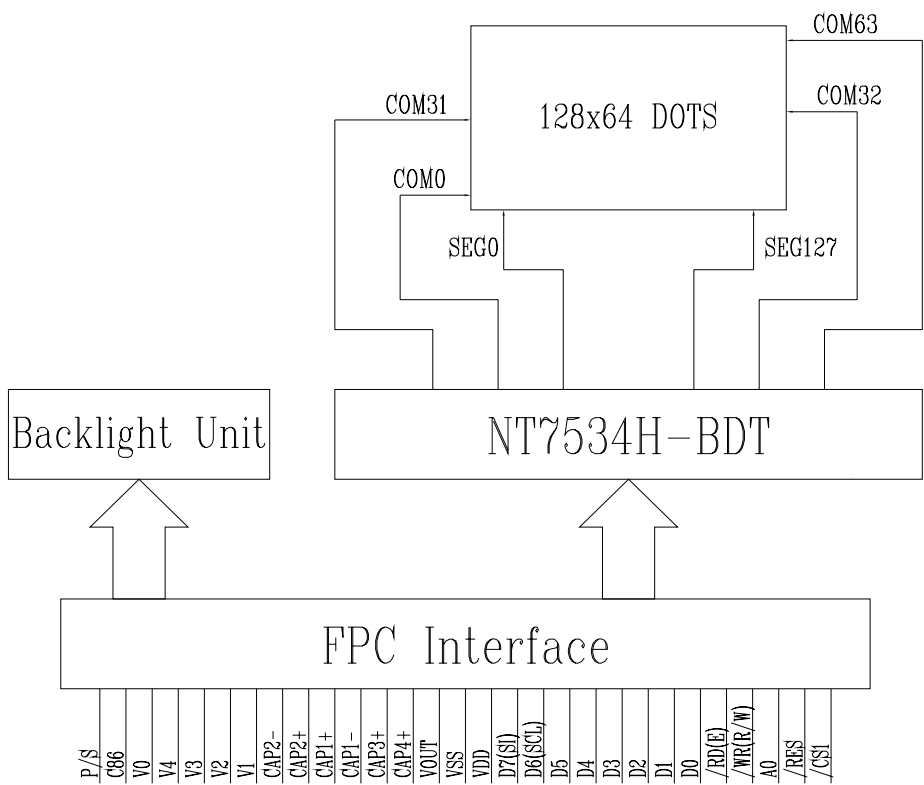
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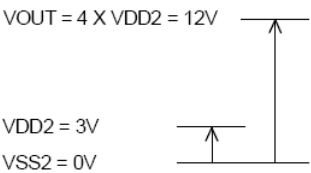
1. GENERAL DESCRIPTION

No.	Item	Specification	Unit
1	Outline Dimension	35.7(W) × 45.4(H) × 3.3max(T)	mm
2	Number of Dots	128(W) × 64(H)	pixels
3	Active Area	27.116(W) × 18.028(H)	mm
4	Viewing Area	31(W) × 21(H)	mm
5	Dot Size	0.192(W) × 0.262(H)	mm
6	Dot Pitch	0.212(W) × 0.282(H)	mm
7	Display Mode	Transflective/Positive	-
8	Display Type	FSTN	-
9	Driving Method	1/65 Duty , 1/9 Bias	-
10	Viewing Direction	6 o'clock	-
11	Input Interface	Parallel and serial interface	-
12	Backlight Unit	LED (Blue)	-
13	Driver IC	NT7534H-BDT	-
14	Weight	-	g

2. FUNCTIONAL BLOCK DIAGRAM

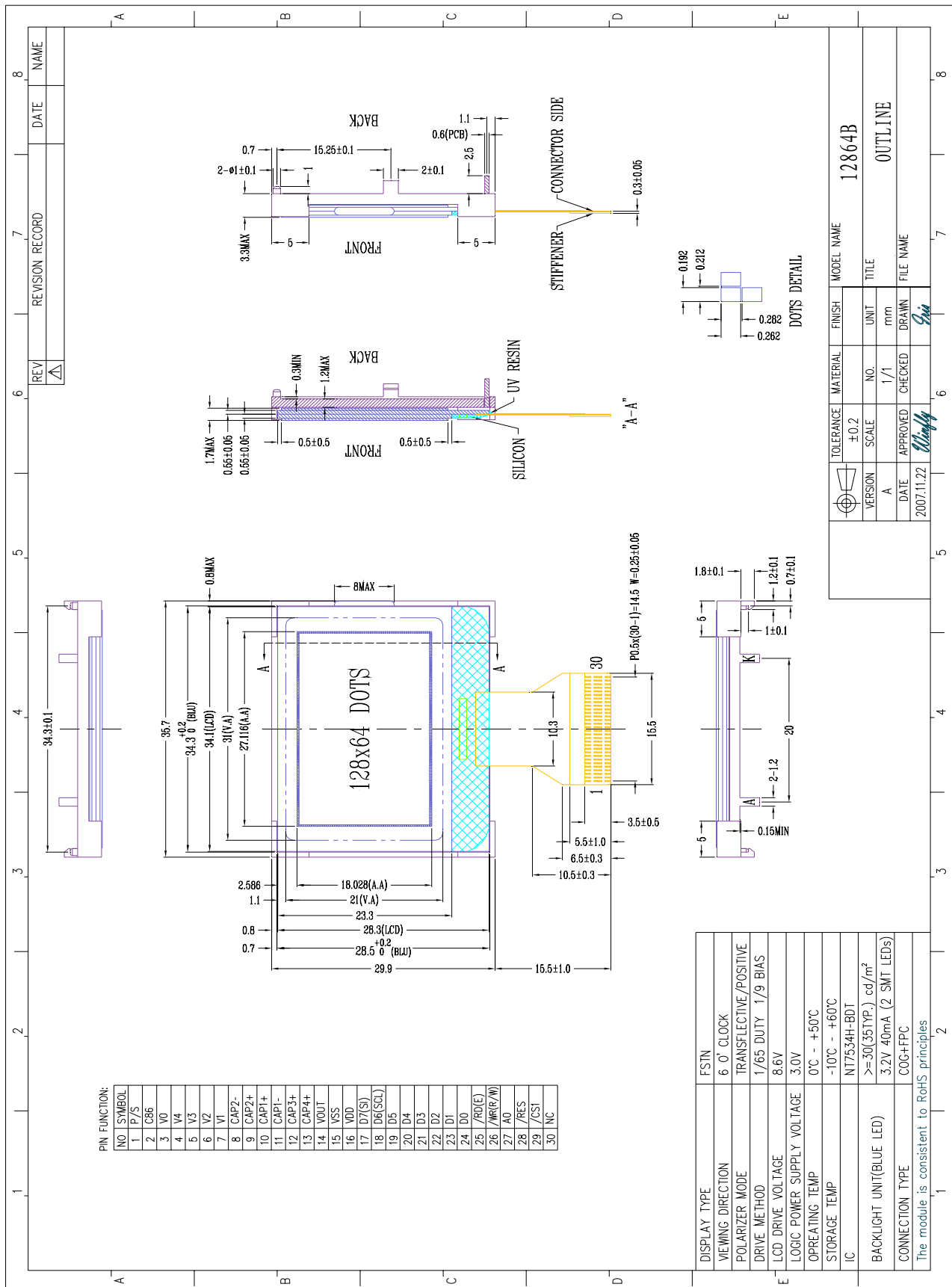


4x step-up voltage circuit



4x step-up voltage relationships

3. MECHANICAL SPECIFICATION



4. PIN DESCRIPTION

No.	Symbol	I/O	Function	Remark
1	P/S	I	P/S="H": Parallel data input, P/S="L": serial data input.	
2	C86	I	C86="H": 6800 series MPU interface; C86="L": 8080 series MPU interface.	
3	V0	P	LCD driver supply voltages. The voltage determined by LCD cell is impedance-converted by a resistive driver or an operation amplifier for application. Voltages should be the following relationship: V0>V1>V2>V3>V4>VSS When the on-chip operating power circuit is on, the following are given to V1 to V4 by the on-chip power circuit. Voltage selection is performed by the set LCD bias command.	
4	V4			
5	V3			
6	V2			
7	V1			
8	CAP2-	O	Capacitor for internal DC/DC voltage converter.	
9	CAP2+			
10	CAP1+			
11	CAP1-			
12	CAP3+			
13	CAP4+			
14	VOUT	P	DC/DC voltage converter output.	
15	VSS	P	Ground for logic circuit.	
16	VDD	P	Supply voltage of logic control circuit.	
17	D7(SI)	I/O	This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus. When the serial interface is selected, then D7 serves as the serial data input terminal and D6 serves as the serial lock input terminal. At this time, D0-D5 are set to high impedance. When the chip select is inactive, D0 to D7 are set to high impedance.	
18	D6(SCL)			
19	D5			
20	D4			
21	D3			
22	D2			
23	D1			
24	D0			
25	/RD(E)	I	Operation (data read/write) enable signal.	
26	/WR(R/W)	I	Read/write select signal.	
27	A0	I	Select register. 0: Instruction register (for write) busy flag & address counter(for read), 1: Data register(for write and read).	
28	/RES	I	When /RES is set to "L", the setting are initialized the /RES operation is performed by the /RES signal level.	
29	/CS1	I	This is the chip select signal. When /CS1="L" and CS2="H", then the chip select becomes active, and data/command I/O is enabled.	

5. Electrical Characteristics

5.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Values		Unit	Remark
		Min	Max.		
Supply Voltage for Logic	$V_{DD} - V_{SS}$	-0.3	4.0	V	
Input Voltage	V_{IN}	-0.3	12	V	
Operating Temp.	T_{op}	0	50	°C	
Storage Temp.	T_{st}	-10	60	°C	

5.2 DC ELECTRICAL CHARACTERISTICS

5.2.1 LCD DC CHARACTERISTICS

Typical Operating Conditions ($T_a=25^{\circ}\text{C}$)

Item		Symbol	Test condition	Values			Unit	Remark
				Min	Typ	Max.		
Logic Supply Voltage		$V_{DD} - V_{SS}$	-	-	3.0	-	V	
LCD Drive		V_{LCD}		8.4	8.6	8.8	V	
Input Voltage	V_{IH}	$V_{DD}=3.0V \pm 5\%$	-	0.8 VDD	-	VDD	V	
	V_{IL}		-	VSS	-	0.2 VDD	V	
Output Voltage	V_{OH}	$V_{DD}=3.0V \pm 5\%$	-	0.8 VDD	-	VDD	V	
	V_{OL}		-	VDD	-	0.2 VDD	V	
Current Consumption		I_{DD}	-	-	0.27	2	mA	

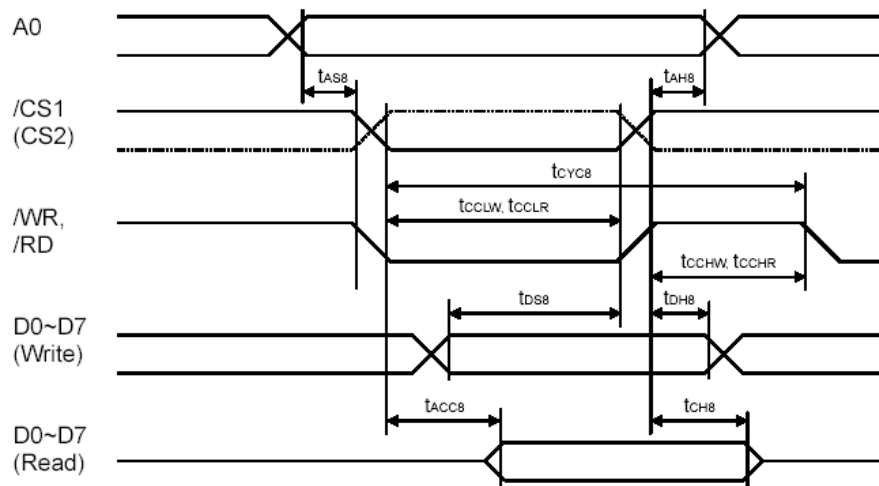
5.2.2 BACKLIGHT UNIT (GND=0V)

Condition $T_a=25^{\circ}\text{C}$

Item	Symbol	Values			Unit	Remark
		Min	Typ	Max.		
Forward Current	I_F	-	40	-	mA	
Forward Voltage	V_F	-	3.2	-	V	$I_F=40\text{mA}$
Backlight Luminous	-	45	50	-	cd/m^2	$I_F=40\text{mA}$
Emission wavelength	λ_p	467	470	473	nm	$I_F=40\text{mA}$

5.3 AC TIMING DIAGRAMS

System bus read/write characteristics 1 (8080 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	

(VDD = 1.8 ~ 2.7V, 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	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	

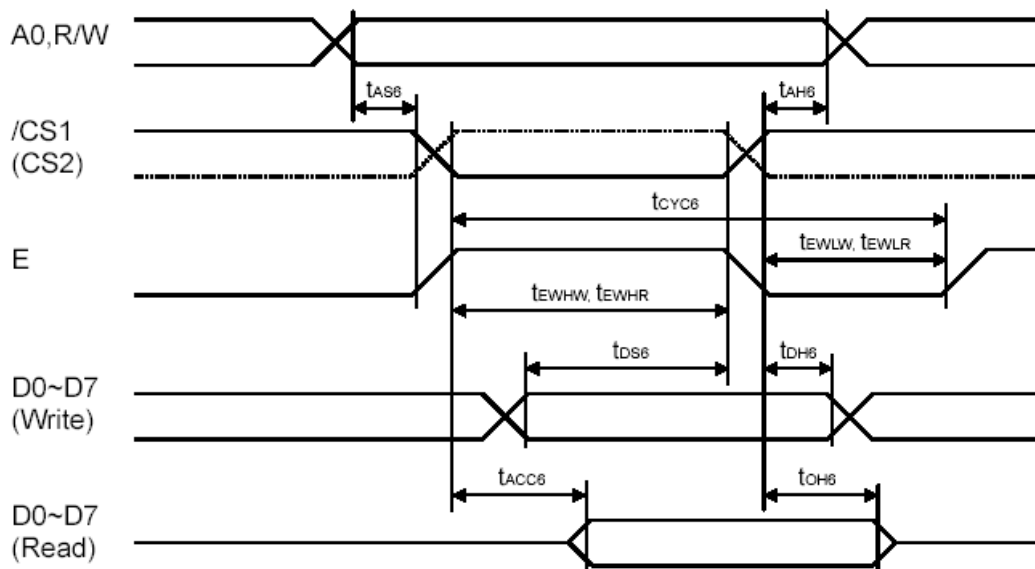
*1. The input signal rise time and fall time (t_r, t_f) is specified at 15ns or less.

(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.

System bus read/write characteristics 2 (6800 Series MPU)



(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	

(VDD = 1.8 ~ 2.7V, 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	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	

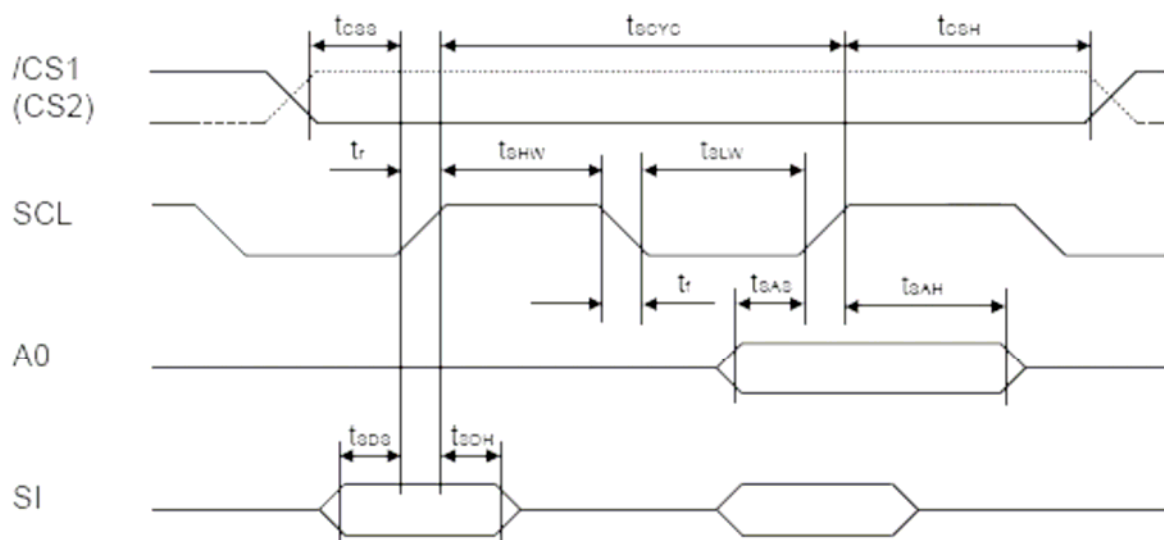
*1. The input signal rise time and fall time (t_r, t_f) is specified at 15ns or less.

(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.

System bus read/write characteristics 3 (Serial Interface Timing)



(VDD = 2.7 ~ 3.6V, Ta = -40 ~ +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{cyc}	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_{as}	Address setup time	30	-	-	ns	A0
t_{ah}	Address hold time	20	-	-	ns	A0
t_{ds}	Data setup time	30	-	-	ns	SI
t_{dh}	Data hold time	20	-	-	ns	SI
t_{css}	Chip select setup time	20	-	-	ns	$\overline{\text{CS1}}$, CS2
t_{csh}	Chip select hold time	40	-	-	ns	$\overline{\text{CS1}}$, 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.

6. INSTRUCTION SET

Table 14. Command Table

Command	A0	/RD	/WR	Code									Hex	Function
				D7	D6	D5	D4	D3	D2	D1	D0			
(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	0	E0h	Increments column address counter during each write
(13)End	0	1	0	1	1	1	0	1	1	1	0	0	EEh	Releases the Read-Modify-Write
(14)Reset	0	1	0	1	1	1	0	0	0	1	0	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 Electronic Volume Register Set	0	1	0	1	0	0	0	0	0	0	1	0	81h	
	0	1	0	*	*	Electronic Control Value						XX	Sets the V0 output voltage electronic volume register	
(19)Set Static indicator ON/OFF Set Static Indicator Register	0	1	0	1	0	1	0	1	1	0	0	1	ACh ADh	Sets static indicator ON/OFF 0: OFF, 1: ON
	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	0	E3h	Command for non-operation

Command Table (continue)

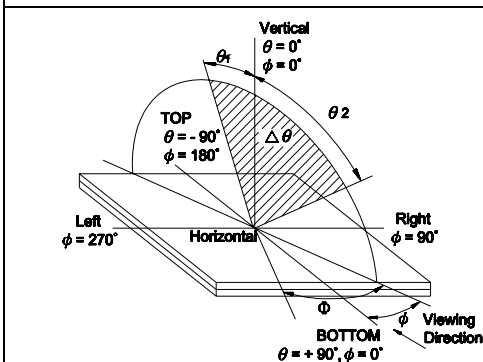
Command	A0	/RD	/WR	Code									Hex	Function
				D7	D6	D5	D4	D3	D2	D1	D0			
(22)Oscillation Frequency Select	0	1	0	1	1	1	0	0	1	0	0	1	E4h E5h	Select the oscillation frequency
(23)Partial Display mode Set	0	1	0	1	0	0	0	0	0	1	0	1	82h 83h	Enter/Release the partial display mode
(24)Partial Display Duty Set	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	

Note: Do not use any other command, or system malfunction may result.

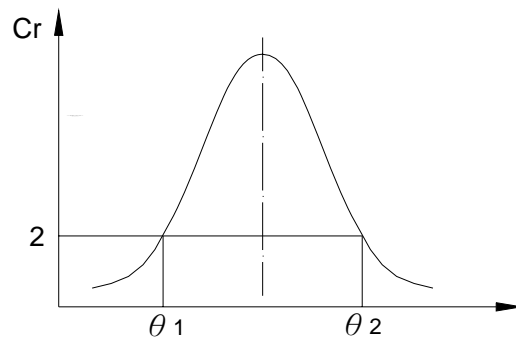
7. OPTICAL CHARACTERISTICS

Item	Symbol	Values			Unit	Conditions	Temp	Remark
		Min	Typ	Max.				
Viewing angle	$ \theta_2 - \theta_1 $	30	84	-	Deg.	-	25°C	1,2
	Φ	60	90	-				
Contrast Ratio	Cr	2	5	-	-	$\theta=0^\circ$ $\Phi=0^\circ$	25°C	3
Response Time(rise)	Tr	-	63	250	ms	$\theta=0^\circ$ $\Phi=0^\circ$	25°C	4
		-	950	1150			0°C	
Response Time(fall)	Tf	-	120	250	ms	$\theta=0^\circ$ $\Phi=0^\circ$	25°C	4
		-	950	1150			0°C	

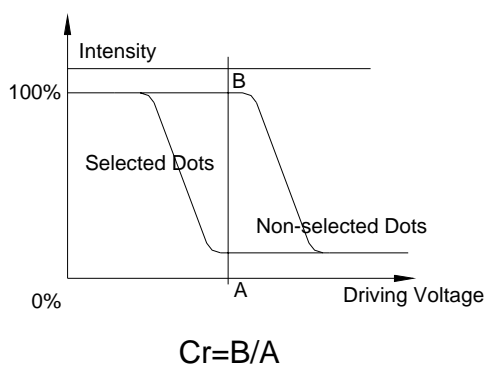
Note1 . Definition of Angle θ & Φ



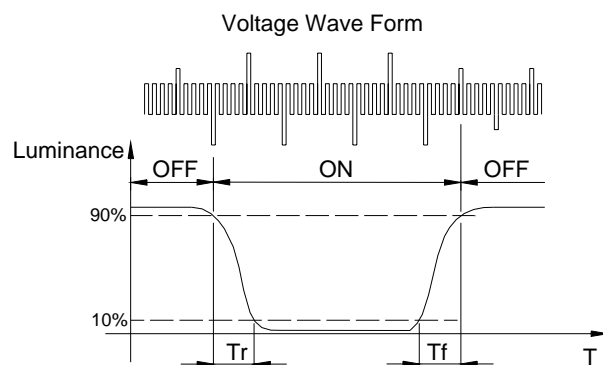
Note2. Definition of Viewing Angle θ_1 & θ_2



Note3 . Definition of Contrast Cr



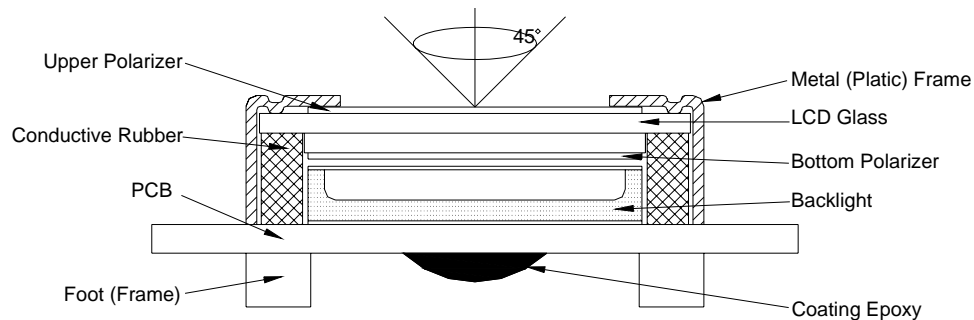
Note4. Definition of Optical Response



8. QUALITY SPECIFICATIONS

8.1 LCM APPEARANCE AND ELECTRIC INSPECTION CONDITION

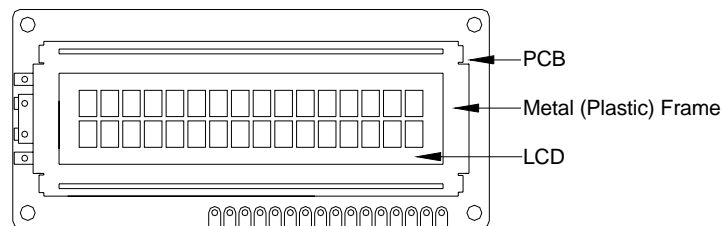
8.1.1 Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.



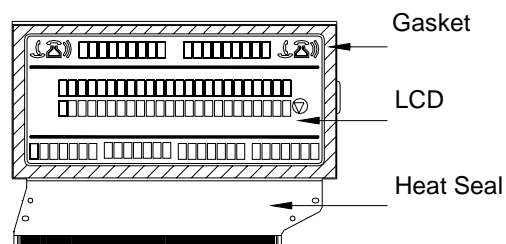
8.1.2 View Angle: with in 45° around perpendicular line.

8.2 DEFINITION

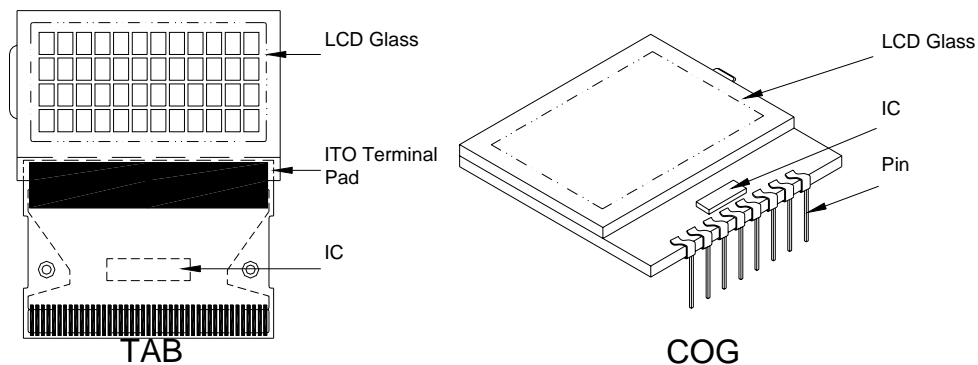
8.2.1 COB



8.2.2 Heat Seal



8.2.3 TAB AND COG



8.3 SAMPLING PLAN AND ACCEPTANCE

8.3.1 Sampling Plan

MIL - STD - 105E (II) ordinary single inspection is used.

8.3.2 Acceptance

Major defect: AQL = 0.25%

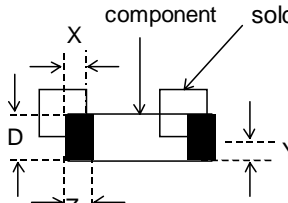
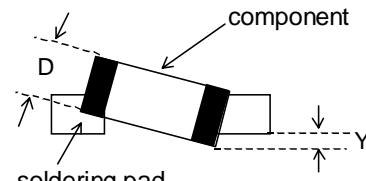
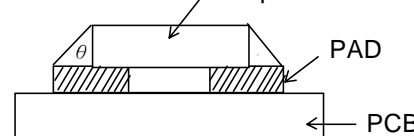
Minor defect: AQL = 0.65%

8.4 CRITERIA

8.4.1 COB

Defect	Inspection Item	Inspection Standards	
Major	PCB copper flakes peeling off	Any copper flake in viewing Area should be greater than 1.0mm ²	Reject
Major	Height of coating epoxy	Exceed the dimension of drawing	Reject
Major	Void or hole of coating epoxy	Expose bonding wire or IC	Reject
Major	PCB cutting defect	Exceed the dimension of drawing	Reject

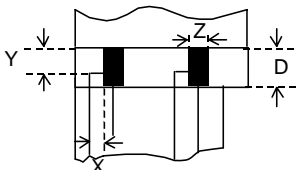
8.4.2 SMT

Defect	Inspection Item	Inspection Standards	
Minor	Component marking not readable		Reject
Minor	Component height	Exceed the dimension Of drawing	Reject
Major	Component solder defect (missing , extra, wrong component or wrong orientation)		Reject
Minor	Component position shift 	$X < 3/4Z$ $Y > 1/3D$	Reject Reject
Minor	Component tilt 	$Y > 1/3D$	Reject
Minor	Insufficient solder 	$\theta \leq 20^\circ$	Reject

8.4.3 METAL (PLASTIC) FRAME

Defect	Inspection Item	Inspection Standards		
Major	Crack / breakage	Anywhere		Reject
Minor	Frame Scratch	W	L	Acceptable of Scratch
		$w < 0.1\text{mm}$	Any	Ignore
		$0.1 \leq w < 0.2\text{mm}$	$L \leq 5.0\text{mm}$	2
		$0.2 \leq w < 0.3\text{mm}$	$L \leq 3.0\text{mm}$	1
		$w \geq 0.3\text{mm}$	Any	0
		Note : 1. Above criteria applicable to scratch lines with distance greater than 5mm. 2. Scratch on the back side of frame (not visible) can be ignored .		
Minor	Frame Dent , Prick $\Phi = \frac{L + W}{2}$			Acceptable of Dents / Pricks
		$\Phi \leq 1.0\text{mm}$		2
		$1.0 < \Phi \leq 1.5\text{mm}$		1
		$1.5\text{mm} < \Phi$		0
		Note : 1. Above criteria applicable to any two dents / pricks with distance greater than 5mm 2. Dent / prick on the back side of frame (not visible) can be ignored		
Minor	Frame Deformation	Exceed the dimension of drawing		
Minor	Metal Frame Oxidation	Any rust		

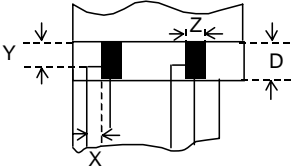
8.4.4 FLEXIBLE FILM CONNECTOR (FFC)

Defect	Inspection Item	Inspection Standards	
Minor	Tilted soldering	Within the angle $+5^\circ$	Acceptable
Minor	Uneven solder joint /bump		Reject
Minor	Hole $\Phi = \frac{L + W}{2}$	Expose the conductive line	Reject
		$\Phi > 1.0\text{mm}$	Reject
Minor	Position shift 	$Y > 1/3D$	Reject
		$X > 1/2Z$	Reject

8.4.5 SCREW

Defect	Inspection Item	Inspection Standards	
Major	Screw missing/loosen		Reject
Minor	Screw oxidation	Any rust	Reject
Minor	Screw deformation	Difficult to accept screw driver	Reject

8.4.6 HEATSEAL 、TCP 、FPC

Defect	Inspection Item		Inspection Standards	
Major	Scratch expose conductive layer			Reject
Minor	HS Hole	$\Phi = \frac{L + W}{2}$	$\Phi > 0.5\text{mm}$	Reject
Major	Adhesion strength		Less than the specification	Reject
Minor	Position shift 		$Y > 1/3D$	Reject
			$X > 1/2Z$	Reject
Major	Conductive line break			Reject

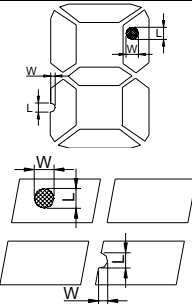
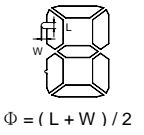
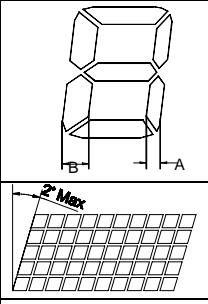
8.4.7 LED BACKING PROTECTIVE FILM AND OTHERS

Defect	Inspection Item	Inspection Standards	
Minor	LED dirty, prick	Acceptable number of units	
		$\Phi \leq 0.10\text{mm}$	Ignore
		$0.10 < \Phi \leq 0.15\text{mm}$	2
		$0.15 < \Phi \leq 0.2\text{mm}$	1
		$\Phi > 0.2\text{mm}$	0
		The distance between any two spots should be $\geq 5\text{mm}$ Any spot/dot/void outside of viewing area is acceptable	
Minor	Protective film tilt	Not fully cover LCD	Reject
Major	COG coating	Not fully cover ITO circuit	Reject

8.4.8 ELECTRIC INSPECTION

Defect	Inspection Item	Inspection Standards	
Major	Short		Reject
Major	Open		Reject

8.4.9 INSPECTION SPECIFICATION OF LCD

Defect	Inspect Item		Inspection Standards				
Minor	Linear Defect	<ul style="list-style-type: none"> * Glass Scratch * Polarizer Scratch * Fiber and Linear material 	W	$W \leq 0.03$	$0.03 < W \leq 0.05$	$W > 0.05$	
			L	$L < 5$	$L < 3$	Any	
			ACC. NO.	1	1	Reject	
			Note	L is the length and W is the width of the defect			
Minor	Black Spot and Polarizer Pricked	<ul style="list-style-type: none"> * Foreign material between glass and polarizer or glass and glass * Polarizer hole or * Protuberance by external force 	Φ	$\Phi < 0.1$	$0.1 < \Phi \leq 0.15$	$0.15 < \Phi \leq 0.2$	$\Phi > 0.2$
			ACC. NO.	3EA / 100mm ²	2	1	0
			Note	Φ is the average diameter of the defect. Distance between two defects > 10mm.			
Minor	White Spot and Bubble in Polarizer	<ul style="list-style-type: none"> * Unobvious transparent foreign material between glass and glass or glass and polarizer * Air protuberance between polarizer and glass 	Φ	$\Phi \leq 0.3$	$0.3 < \Phi \leq 0.5$	$0.5 < \Phi$	
			ACC. NO.	3EA / 100mm ²	1	0	
			Note	Φ is the average diameter of the defect. Distance between two defects > 10mm.			
Minor	Segment Defect		Φ	$\Phi \leq 0.10$	$0.10 < \Phi \leq 0.20$	$0.20 < \Phi \leq 0.25$	$\Phi > 0.25$
			ACC. NO.	3EA / 100mm ²	2	1	0
			Note	W is more than 1/2 segment width			Reject
				$\Phi = \frac{L + W}{2}$ Distance between two defect is 10mm			
Minor	Protuberant Segment	 $\Phi = (L + W) / 2$	Φ	$\Phi \leq 0.10$	$0.10 < \Phi \leq 0.20$	$0.20 < \Phi \leq 0.25$	$\Phi > 0.25$
			W	Glue	$W \leq 1/2$ Seg $W \leq 0.2$	$W \leq 1/2$ Seg $W \leq 0.2$	Ignore
			ACC. NO.	3EA / 100mm ²	2	1	0
Minor	Assembly Mis-alignment		1. Segment				
			B	$B \leq 0.4\text{mm}$	$0.4 < B \leq 1.0\text{mm}$	$B > 1.0\text{mm}$	
			B-A	$B-A < 1/2B$	$B-A < 0.2$	$B-A < 0.25$	
			Judge	Acceptable	Acceptable	Acceptable	
			2. Dot Matrix				
			Deformation > 2°				Reject
Minor	Stain on LCD Panel Surface		Accept when stains can be wiped lightly with a soft cloth or a similar one. Otherwise, judged according to the above items: "Black spot" and "White Spot"				

9. RELIABILITY

NO.	Item	Condition	Criterion
1	High Temperature Operating	50°C , 96Hrs	No defect in cosmetic and operational function allowable. Total current Consumption should be below double of initial value.
2	Low Temperature Operating	0°C , 96Hrs	
3	High Humidity	50°C , 90%RH, 96Hrs	
4	High Temperature Storage	60°C , 96Hrs	
5	Low Temperature Storage	-10°C , 96Hrs	
6	Vibration	Random wave 10 ~ 100Hz Acceleration: 2g 2 Hrs per direction (X,Y,Z)	
7	Thermal Shock	0°C to 25°C to 50°C (60Min) (5Min) (60Min) 16Cycles	
8	ESD Testing	Contract Discharge Voltage: +1 ~ 5kV and -1 ~ -5kV Air Discharge Voltage: +1 ~ 8kV and -1 ~ -8kV	There will be discharged ten times at every discharging voltage cycle. The voltage gap is 1kV.

Note: 1) Above conditions are suitable for SAZENTO standard products.
2) For restrict products, the test conditions listed as above must be revised.

10. HANDLING PRECAUTION

(1) MOUNTING METHOD

The panel of the LCD Module consists of two thin glass plates with polarizers which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

(2) CAUTION OF LCD HANDLING & CLEANING

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichloro triflurothane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface. Do not use the following solvent:

- Water
- Ketone
- Aromatics

(3) CAUTION AGAINST STATIC CHARGE

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

(4) PACKAGING

- Modules use LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

(5) CAUTION FOR OPERATION

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's. Which will come back in the specified operating temperature range.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in

terminal open circuit. Usage under the relative condition of 40°C, 50%RH or less is reequired.

(6) STORAGE

In the case of storing for a long period of time (for instance.) For years) for the purpose or replacement use, The following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.
- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

(7) SAFETY

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol. Which should be burned up later.
- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.