

LCD Module

Product Specification

: APPROVAL FOR SPECIFICATION

For Customer : _____ : APPROVAL FOR SAMPLE

Module No. : TSM0802B

For Customer's Acceptance :

Approved by	Comment

Team Source Display :

Presented by	Reviewed by	Organized by

Revision history

revision	date	description	remark
A00	2008-04-28	First release	
A01	2008-05-06	Change Power supply	3.3V

Content

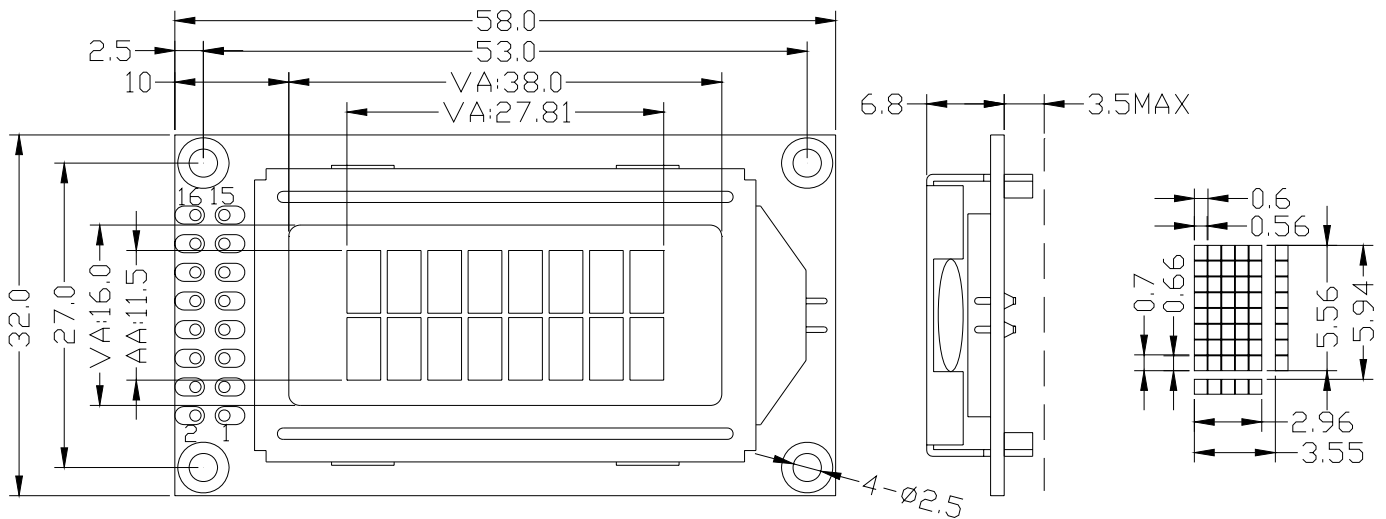
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1. Feature

Display format	: 8(characters) X 2(lines)
Display mode	: STN , Positive , transfective
Driving method	: 1/16 duty , 1/5 bias
Viewing direction	: 6 o'clock
Built-in controller	: S6A0069(or equivalence)
Backlight color	: White
Operation temp	: -0°C~50°C
Storage temp	: -10°C~60°C

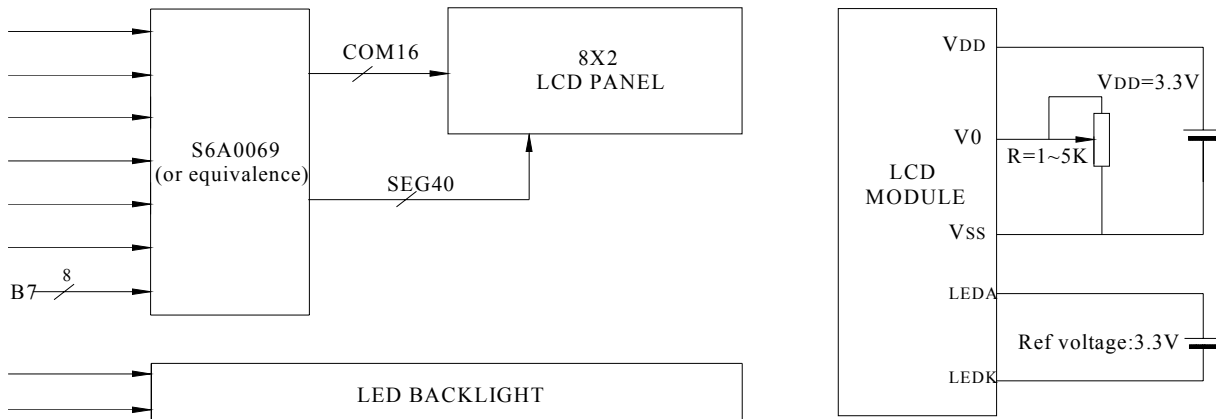
2. Mechanical Specifications

Dimensional outline (W*H*T)	: 58.0mm*32.0mm*10.3mm
Viewing area (W*H)	: 38.0mm*16.0mm
Character pitch(W*H)	: 3.55mm*5.94mm
Character size(W*H)	: 2.96mm*5.56mm
Character font	: 5*8
Dot pitch (W*H)	: 0.6mm*0.7mm
Dot size (W*H)	: 0.56mm*0.66mm
Weight	: Approx



outline dimension

3. Block Diagram & Power supply



4. Pin description

Pin No.	Pin Name	Function
1	VSS	Power supply (ground)
2	VDD	Power supply (+3.3V)
3	V0	Power supply for LCD driver
4	RS	Register selection (H : data register ; L : instruction register)
5	R/W	Write/Read signal (H : read ; L : write)
6	E	Write/Read enable signa
7~14	DB0~DB7	Data bus
15	LEDA	Power supply for backlight+(+3.3V)
16	LEDK	Power supply for backlight-

5. Absolute Maximum Ratings

Items	Symbol	MIN.	MAX.	Unit	Condition
Supply Voltage	VDD	-0.3	7.0	V	Vss = 0V
	Vlcd	-15.0	+7	V	Vss = 0V
Input Voltage	VIN	-0.3	VDD+0.3	V	Vss = 0V
LED forward current	If	---	20	mA	---
Operating Temperature	TOP	-0	+50	°C	---

Storage Temperature	Tst	-10	+60	°C	---
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6. Electrical Characteristics

6.1 DC Characteristics

(V_{SS} = 0V, V_{DD} = 5.0V ± 10%, Ta = -20~75°C)

Items	Symbol	MIN.	TYP.	MAX.	Unit
Operating Voltage	V _{DD}	3.0	3.3	3.6	V
Input High Voltage	V _{IH}	0.8V _{DD}	-	V _{DD}	V
Input Low Voltage	V _{IL}	V _{SS}	-	0.2V _{DD}	V
Output High Voltage	V _{OH}	0.8V _{DD}	-	V _{DD}	V
Output Low Voltage	V _{OL}	V _{SS}	-	0.2V _{DD}	V
Supply Current	I _{DD}	---	---	5	mA

6.2 AC Characteristics

(V_{DD} = 4.5 to 5.5V, Ta = -30 to +85°C)

Mode	Characteristics	Symbol	Min	Typ	Max	Unit
Write Mode (refer to Figure-6)	E Cycle Time	t _c	500	-	-	ns
	E Rise / Fall Time	t _R , t _F	-	-	20	
	E Pulse Width (High, Low)	t _w	230	-	-	
	R/W and RS Setup Time	t _{su1}	40	-	-	
	R/W and RS Hold Time	t _{H1}	10	-	-	
	Data Setup Time	t _{su2}	80	-	-	
	Data Hold Time	t _{H2}	10	-	-	
Read Mode (refer to Figure-7)	E Cycle Time	t _c	500	-	-	ns
	E Rise / Fall Time	t _R , t _F	-	-	20	
	E Pulse Width (High, Low)	t _w	230	-	-	
	R/W and RS Setup Time	t _{su}	40	-	-	
	R/W and RS Hold Time	t _H	10	-	-	
	Data Output Delay Time	t _D	-	-	120	
	Data Hold Time	t _{DH}	5	-	-	

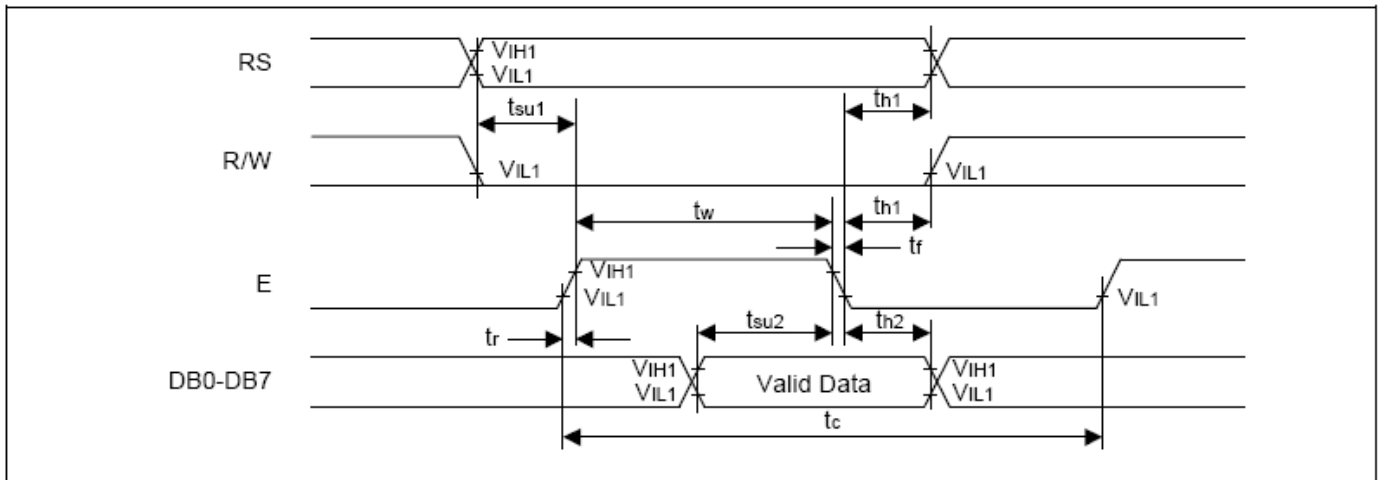


Figure 6. Write Mode Timing Diagram

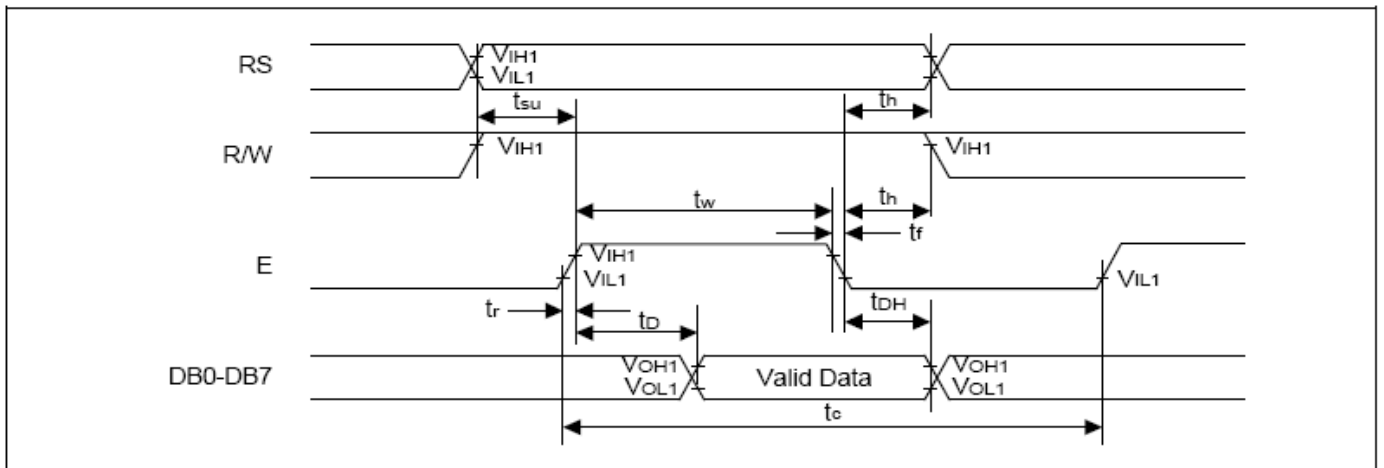


Figure 7. Read Mode Timing Diagram

7. Backlight Characteristics

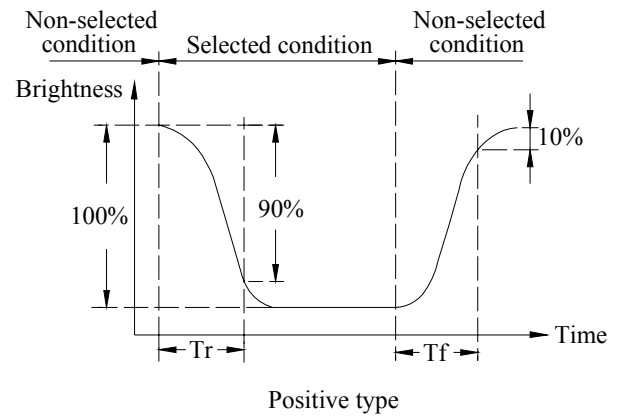
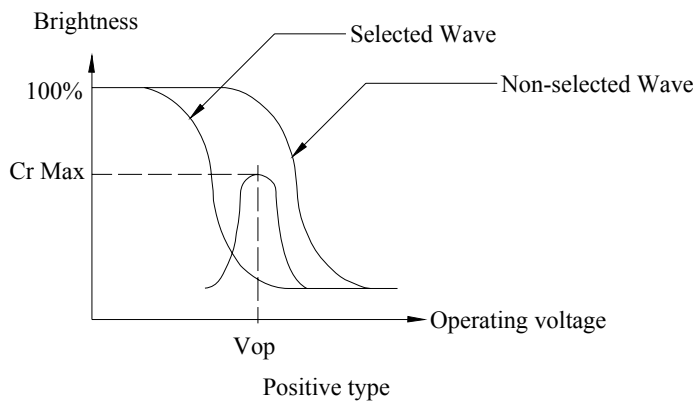
Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forward Voltage	V _f	2.8	3.0	3.3	V	I _f =15mA
Reverse current	I _r	--	-	100	uA	V _r =5V
Peak wave length	λ	-	-	-	nM	I _f =15mA
Luminance	L _v	-	-	-	Cd/m ²	I _f =15mA
Color	White					

8. Electrical-Optical Characteristics

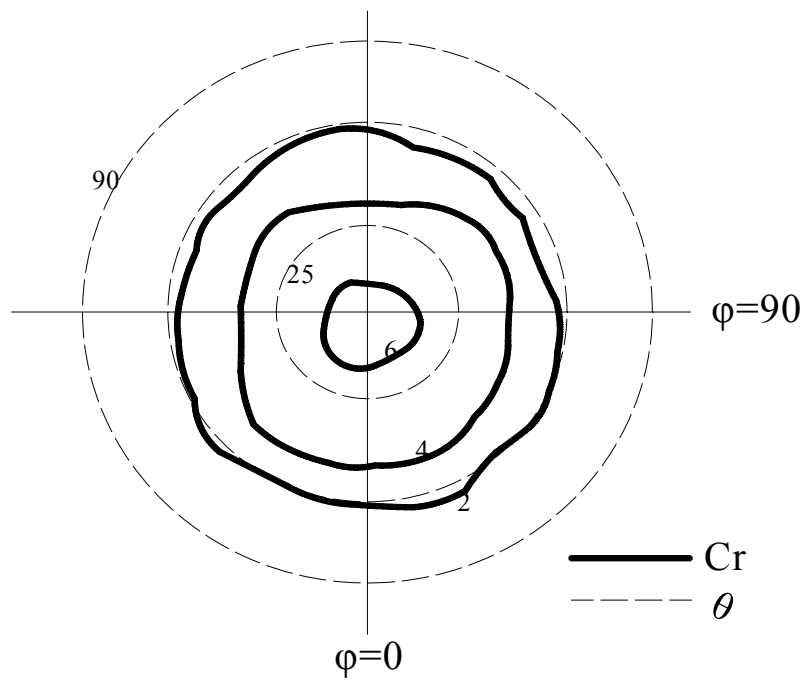
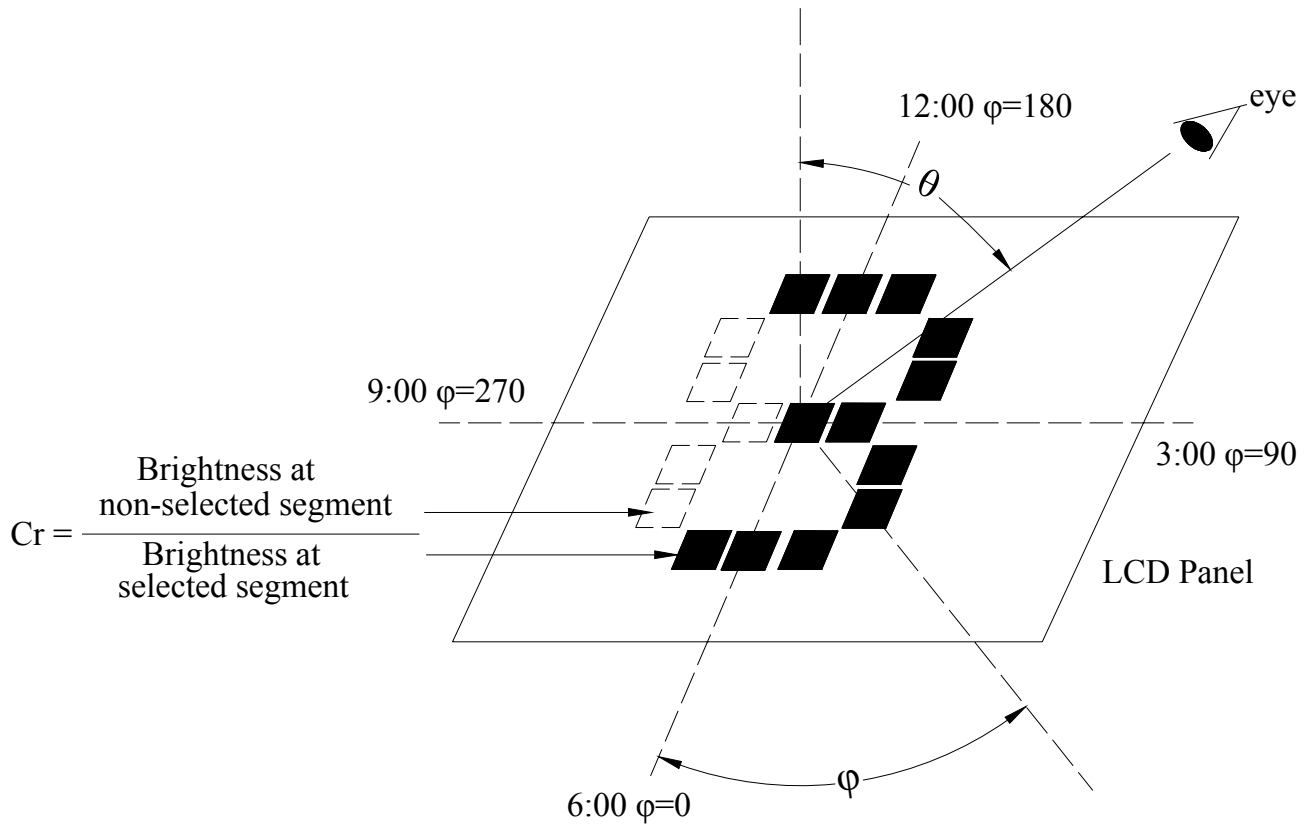
Items	Symbol	Condition	MIN.	TYP.	MAX.	Unit	NOTE
Operation Voltage	Vop	Ta= 0°C	5.2	5.5	5.8	V	1
		Ta= 25°C	4.7	5.0	5.3		
		Ta= 50°C	4.2	4.5	4.8		
Response time	Tr	Ta= 25°C	---	185	---	ms	2
	Tf		---	200	---		
Contrast ratio	Cr	Ta= 25°C	---	5	---	degree	3
Viewing angle range	θ	Cr \geq 2	-40	---	40		

Note1 Definition of Operation voltage

Note2 Definition of Response time



Note3 Definition of Contrast ratio、 Viewing angle and direction



9. Control and display commands

Instruction	Code										Function	Execution time (max) ($f_{osc} = 250\text{KHz}$)	
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Display Clear	0	0	0	0	0	0	0	0	0	0	1	Clear entire display area, restore display from shift, and load address counter with DD RAM address 00H.	1.64ms
Display/ Cursor Home	0	0	0	0	0	0	0	0	0	1	*	Restore display from shift and load address counter with DD RAM address 00H.	1.64ms
Entry Mode Set	0	0	0	0	0	0	0	0	1	I/D	S	Specify direction of cursor movement and display shift mode. This operation takes place after each data transfer (read/write).	40 μ s
Display ON/OFF	0	0	0	0	0	0	0	1	D	C	B	Specify activation of display (D) cursor (C) and blinking of character at cursor position (B).	40 μ s
Display/ Cursor Shift	0	0	0	0	0	0	1	S/C	R/L	*	*	Shift display or move cursor.	40 μ s
Function Set	0	0	0	0	1	DL	N	F	*	*	*	Set interface data length (DL), number of display line (N), and character font (F).	40 μ s
RAM Address Set	0	0	0	1	ACG						Load the address counter with a CG RAM address. Subsequent data access is for CG RAM data.	40 μ s	
DD RAM Address Set	0	0	1	ADD						Load the address counter with a DD RAM address. Subsequent data access is for DD RAM data.	40 μ s		
Busy Flag/ Address Counter Read	0	1	AC						Read Busy Flag (BF) and contents of Address Counter (AC).	40 μ s			
CG RAM/ DD RAM Data Write	1	0	Write data						Write data to CG RAM or DD RAM.	40 μ s			
CG RAM/ DD RAM Data Read	1	1	Read data						Read data from CG RAM or DD RAM.	40 μ s			
	I/D = 1 : Increment S = 1 : Display Shift On D = 1 : Display On C = 1 : Cursor Display On B = 1 : Cursor Blink On S/C = 1 : Shift Display R/L = 1 : Shift Right DL = 1 : 8-Bit N = 1 : Dual Line F = 1 : 5x10 dots BF = 1 : Internal Operation BF = 1 : Ready for Instruction										I/D = 0 : Decrement S/C = 0 : Move Cursor R/L = 0 : Shift Left DL = 0 : 4-Bit N = 0 : Signal Line F = 0 : 5x8 dots	DD RAM : Display Data RAM CG RAM : Character Generator RAM ACG : Character Generator RAM Address ADD : Display Data RAM Address AC : Address Counter	

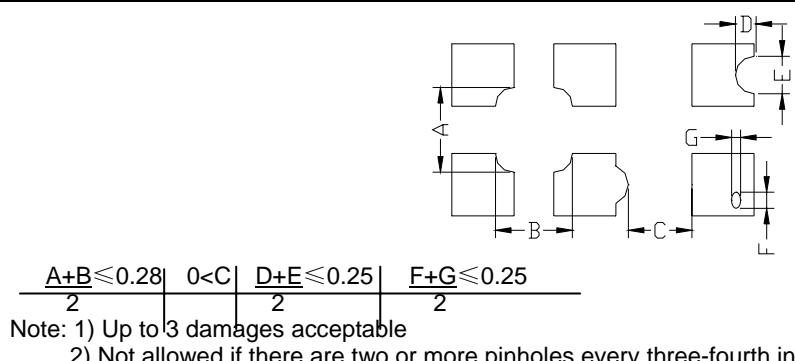
Note 1: Symbol "*" signifies an insignificant bit (disregard).

Note 2: Correct input value for "N" is predetermined for each model.

10. Character Generator ROM

		Higher 4-bit (D4 to D7) of Character Code (Hexadecimal)																	
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F		
Lower 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	CG RAM (1)			0	a	P	`	P					—	9	3	e	p	
	1	CG RAM (2)		!	1	A	Q	a	9					•	7	7	4	a	9
	2	CG RAM (3)		"	2	B	R	b	r					「	イ	ウ	×	P	θ
	3	CG RAM (4)		#	3	C	S	c	s					」	ウ	7	7	e	ω
	4	CG RAM (5)		\$	4	D	T	d	t					、	エ	ト	ト	H	Ω
	5	CG RAM (6)		%	5	E	U	e	u					、	オ	ナ	1	2	Ü
	6	CG RAM (7)		&	6	F	V	f	v					ヲ	カ	ニ	ヨ	P	Σ
	7	CG RAM (8)		'	7	G	W	g	w					ア	キ	ヌ	ラ	9	π
	8	CG RAM (1)		(8	H	X	h	x					イ	ウ	ホ	リ	5	Σ
	9	CG RAM (2))	9	I	Y	i	y					ウ	7	ル	ル	-	9
	A	CG RAM (3)		*	=	J	Z	j	z					エ	コ	ル	ル	j	7
	B	CG RAM (4)		+	;	K	Ɔ	k	Ɔ					オ	サ	ヒ	ロ	*	π
	C	CG RAM (5)		,	<	L	≠	l	l					ト	シ	フ	7	Ɔ	π
	D	CG RAM (6)		—	=	M	l	m	3					ユ	ズ	、	ル	ト	÷
	E	CG RAM (7)		•	>	N	^	n	→					ヨ	セ	ホ	、	ñ	
	F	CG RAM (8)		/	?	O	_	o	←					ッ	ッ	マ	”	ö	

11. Inspection Standards

Item	Criterion for defects	Defect type
1) Display on inspection	(1) Non display (2) Vertical line is deficient (3) Horizontal line is deficient (4) Cross line is deficient	Major
2) Black / White spot	Size Φ (mm) Acceptable number $\Phi \leq 0.3$ Ignore (note) $0.3 < \Phi \leq 0.45$ 3 $0.45 < \Phi \leq 0.6$ 1 $0.6 < \Phi$ 0	Minor
3) Black / White line	Length (mm) Width (mm) Acceptable number $L \leq 10$ $W \leq 0.03$ Ignore $5.0 \leq L \leq 10$ $0.03 < W \leq 0.04$ 3 $5.0 \leq L \leq 10$ $0.04 < W \leq 0.05$ 2 $1.0 \leq L \leq 10$ $0.05 < W \leq 0.06$ 2 $1.0 \leq L \leq 10$ $0.06 < W \leq 0.08$ 1 $L \leq 10$ $0.08 < W$ follows 2) point defect Defects separate with each other at an interval of more than 20mm	Minor
4) Display pattern	 <p style="text-align: center;"> $\frac{A+B \leq 0.28}{2}$ $0 < C$ $\frac{D+E \leq 0.25}{2}$ $\frac{F+G \leq 0.25}{2}$ </p> <p>Note: 1) Up to 3 damages acceptable 2) Not allowed if there are two or more pinholes every three-fourth inch.</p>	Minor
5) Spot-like contrast irregularity	Size Φ (mm) Acceptable Number $\Phi \leq 0.7$ Ignore (note) $0.7 < \Phi \leq 1.0$ 3 $1.0 < \Phi \leq 1.5$ 1 $1.5 < \Phi$ 0 Note: 1) Conformed to limit samples. 2) Intervals of defects are more than 30mm.	Minor
6) Bubbles in polarizer	Size Φ (mm) Acceptable Number $\Phi \leq 0.4$ Ignore (note) $0.4 < \Phi \leq 0.65$ 2 $0.65 < \Phi \leq 1.2$ 1 $1.2 < \Phi$ 0	Minor
7) Scratches and dent on the polarizer	Scratches and dent on the polarizer shall be in the accordance with "2) Black/white spot", and "3) Black/White line".	Minor
8) Stains on the surface of LCD panel	Stains which cannot be removed even when wiped lightly with a soft cloth or similar cleaning.	Minor
9) Rainbow color	No rainbow color is allowed in the optimum contrast on state within the active area.	Minor
10) Viewing area encroachment	Polarizer edge or line is visible in the opening viewing area due to polarizer shortness or sealing line.	Minor
11) Bezel appearance	Rust and deep damages that are visible in the bezel are rejected.	Minor
12) Defect of land surface contact	Evident crevices that are visible are rejected.	Minor
13) Parts mounting	(1) Failure to mount parts (2) Parts not in the specifications are mounted (3) For example: Polarity is reversed, HSC or TCP falls off.	Minor
14) Part alignment	(1) LSI, IC lead width is more than 50% beyond pad outline. (2) More than 50% of LSI, IC leads is off the pad outline.	Minor
15) Conductive foreign matter (solder ball, solder hips)	(1) $0.45 < \Phi$, $N \geq 1$ (2) $0.3 < \Phi \leq 0.45$, $N \geq 1$, Φ : Average diameter of solder ball (unit: mm) (3) $0.5 < L$, $N \geq 1$, L : Average length of solder chip (unit: mm)	Minor
16) Bezel flaw	Bezel claw missing or not bent	Minor
17) Indication on name plate (sampling indication label)	(1) Failure to stamp or label error, or not legible.(all acceptable if legible) (2) The separation is more than 1/3 for indication discoloration, in which the characters can be checked.	Minor

12. Reliability test

item	condition	criterion
High temp. operation	50°C 24hrs	No abnormality in function and appearance
High temp. storage	60°C 24hrs	
Low temp. operation	0°C 24hrs	
Low temp. storage	-10°C 24hrs	
Humidity	40°C 90%RH 24hrs	
Thermal shock	0°C(30min)← →50°C(30min) 10cycles	
Vibration	Frequency :10~55HZ Duration : 3times , 3min/time Amplitude : 0.75mm	-

13. Handling precautions

1. Refrain from strong mechanical shock and forces to the module. It may cause improper operating or damage to the module.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. When cleaning the display surface, use soft cloth with a solvent recommended : ethyl alcohol , isopropyl or hexane) and wipe gently, do not use the following solvents : water, ketone or aromatics .
3. Wipe off water or oil drop immediately If you leave drop for a long time, stain and discoloration may occur.
4. Do not touch pads or pins of interface directly with bare hands. When handling the LCD module, put on a soft glover like finger-glover.
5. Protect the module from static electricity, it may cause damage to CMOS LSI.
6. To prevent LCD panels from degradation, do not operate or store them exposed directly to sunlight or high temperature/humidity.
7. If the liquid crystal leaks from the panel it should be kept away from the eyes and mouths. In case of contact with skins, wash away thoroughly with soap and water.
8. Soldering should be only performed on the I/O terminals within the temperature of $280 \pm 20^{\circ}\text{C}$ and soldering time should be less than 4 seconds.
9. Supply voltage within the specified voltage limit, the maximum rating, higher voltage cause the shorter LCD life or damaged.
10. Do not input any signals before power is turned on. Do not connect or disconnect the module on the state of Power-ON.