LCD Module

Product Specification

□：APPROVAL FOR SPECIFICATION

For Customer：_____ □：APPROVAL FOR SAMPLE

Module No.： __TSG12864K1__

For Customer's Acceptance ：

Approved by	Comment

Team Source Display ：

Presented by	Reviewed by	Organized by

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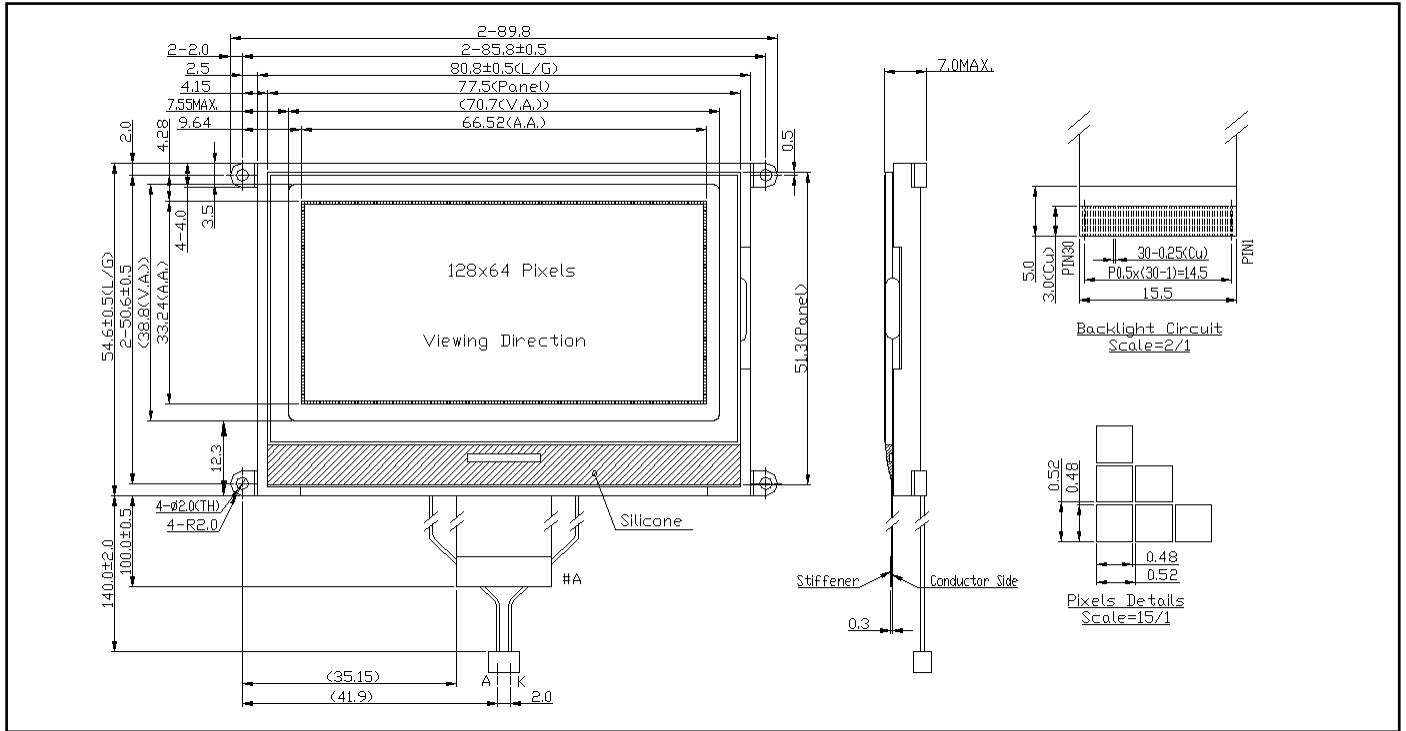
1. Basic Specifications

1.1 Display Specifications
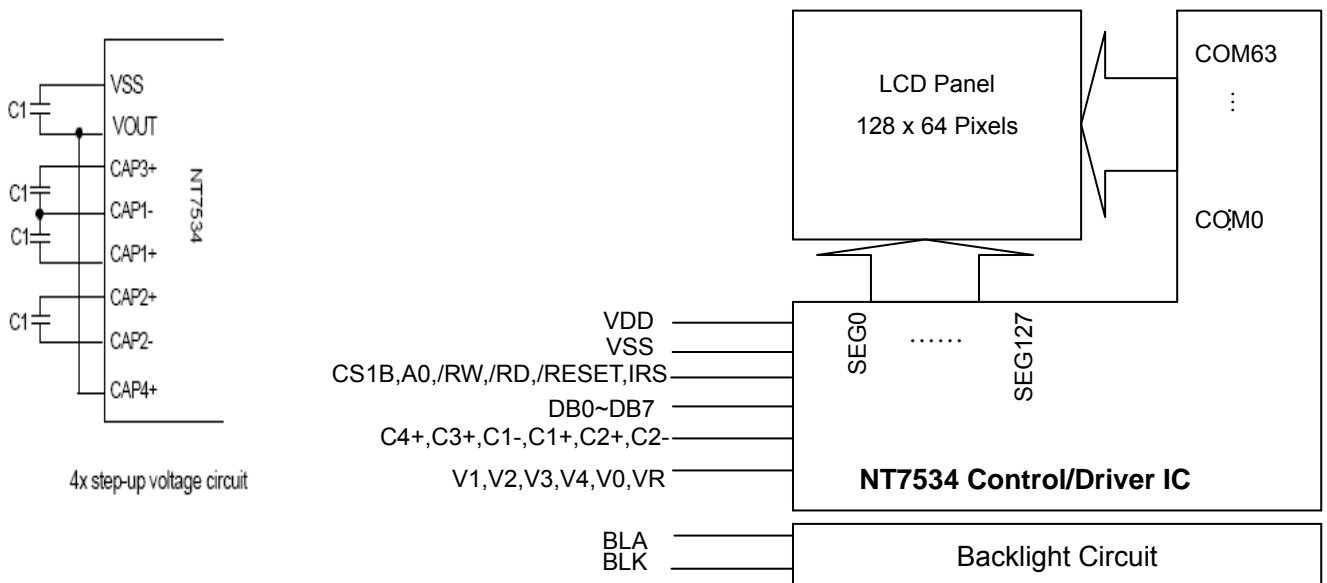
    1>LCD Display Mode   : FSTN, Negative, Transmissive

    2>Viewing Angle   : 6H

    3>Driving Method   : 1/64 Duty, 1/9 Bias

    4>Backlight   : White

1.2 Mechanical Specifications

    1>Outline Dimension   : 89.8 x54.6 x 7.0mm (See attached Outline Drawing for Details)

1.3 Circuit Diagram

1.4 Terminal Function

Pin No.	Pin Name	Function
1	NC	No Connection, Leave Open
2	CS1B	chip selection input
3	RESETB	Reset Signal
4	A0	Data/Command control.
5	WRB	Write (/WR) control signal input.
6	RDB	Read (/RD) control signal input.
7~14	DB0~DB7	8-bit Date bus
15	VDD	Power supply voltage (Positive)
16	VSS	Negative power supply,0V
17	VOUT	Voltage converter input / output pin Connect this pin to Vss through capacitor.
18	CAP4+	Capacitor 4 positive connection pin for voltage converter
19	CAP3+	Capacitor 3 positive connection pin for voltage converter
20	CAP1+	Capacitor 1 positive connection pin for voltage converter
21	CAP1-	Capacitor 1 negative connection pin for voltage converter
22	CAP2+	Capacitor 2 positive connection pin for voltage converter
23	CAP2-	Capacitor 2 negative connection pin for voltage converter
24	V1	LCD driver supplay voltage
25	V2	LCD driver supplay voltage
26	V3	LCD driver supplay voltage
27	V4	LCD driver supplay voltage
28	V0	LCD driver supplay voltage
29	VR	V0 voltage adjustment pin,It is valid only when internal voltage regulator resistors are not used (INTRS = "L").
30	INTRS	Internal resistor select pin This pin selects the resistors for adjusting V0 voltage level and is valid only in master operation. − INTRS = "H": use the internal resistors − INTRS = "L": use the external resistors V0 voltage is controlled by VR pin and external resistive divider.

2. Absolute Maximum Ratings

Items	Symbol	MIN.	MAX.	Unit	Condition
Supply Voltage	V_{DD}	-0.3	+3.6	V	
	VLCD	-0.3	+9.0	V	
Input Voltage	V_{IN}	-0.3	V_{DD}+0.3	V	
Operating Temperature	T_{OP}	-10	+60	℃	
Storage Temperature	Tst	-20	+70	℃	

3. Electrical Characteristics

3.1 DC Characteristics

Vss = 0V,Top = 25℃

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Operating Voltage	V_{DD}	2.7	3.0	3.3	V	
Input High Voltage	V_{IH}	0.8 x V_{DD}	-	V_{DD}	V	
Input Low Voltage	V_{IL}	Vss	-	0.2 x V_{DD}	V	
Output High Voltage	V_{OH}	0.8 x V_{DD}	-	V_{DD}	V	Ioh=-5mA
Output Low Voltage	V_{OL}	Vss	-	0.2 x V_{DD}	V	Ioh=5mA
Input Leakage Current	I_{LI}	-1.0	-	1.0	µA	Vin=VDD or VSS
Output Leakage Current	I_{Lo}	-3.0	-	3.0	µA	Vin=VDD or VSS

3.2 LED Backlight Circuit

Vss = 0V,Top = 25℃

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forword Voltage	Vf BLA	-	3.2	-	V	VDD
Forword Current	If BLA	-	-	80	mA	VDD
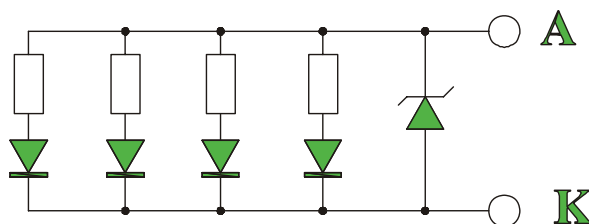
3.3   AC Characteristic

3.3   6800 Mode System Bus Tim
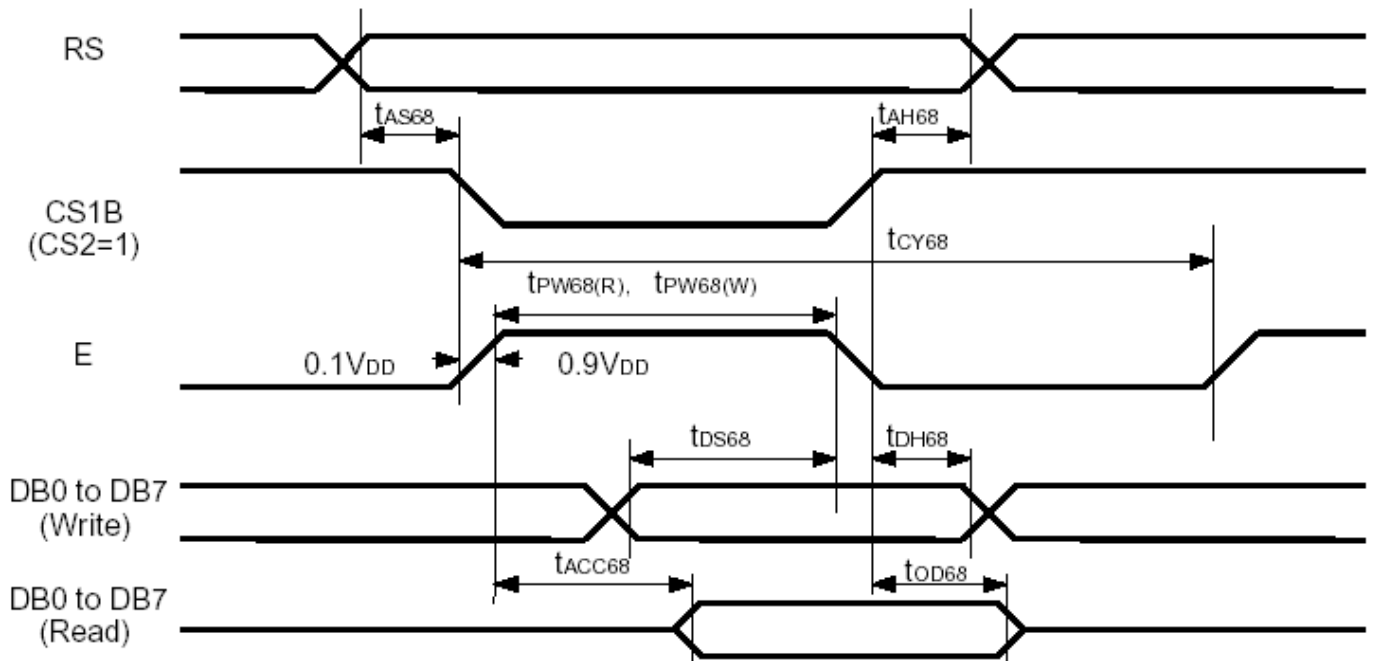
Vss = 0V,Top = 25

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
System cycle time	Tcyc6	240	-	-	ns	-
Address setup time(A0)	Tas6	0	-	-	ns	A0,R/W
Address hold time(A0)	Tah6	0	-	-	ns	
Control High Pulse wide(/RD)	Tewlr	100	-	-	ns	E
Control High Pulse wide(/WR)	Tewlw	100	-	-	ns	E
Data steup time	Tds6	40	-	-	ns	D0~D7
Data hold time	Tdh6	10	-	-	ns	
/RD access time(*a)	Tacc6	-	-	140	ns	D0~D7
Output disable time(*a)	Toh6	5	-	50	ns	CL=100pF

3.4 Reset Timing
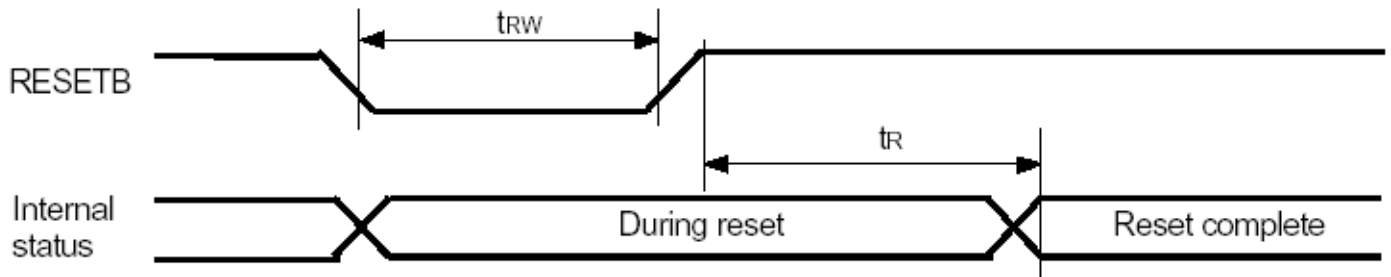
(VDD = 2.7 ~ 3.6V, Ta = -40 ~ +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_R	Reset Time	-	-	1.0	μs	
t_{RW}	Reset low pulse width	10	-	-	μs	/RES

4. Function specifications

4.1 The Parallel Interface

Shared	6800 Mode		Function
A0	R/W	E	
H	H	H	Reads the display data
H	L	H→L	Writes the display data
L	H	H	Staus read
L	L	H→L	Write Command data

4.2 Basic Setting

To drive the LCD module correctly and provide normally display, please use the following seting

1> ADC = 0 (normal)
2> SHL select = 0(reverse)
3> LCD Bias Select = 1/9
4> Initial Display Line = 0
5> Entire Display ON/OF = OFF(normal)
6> Reverse Display ON/OF = OFF(normal)
7> Set Power Control Set:
   Voltage follower = ON,voltage converter = ON,Voltage regulator = ON
8> Display ON/OF =ON

4.3 Resetting the LCD module

The LCD module should be initialized bu using /RES terminal.
While turning on the VDD and VSS power supply, maintain /RES terminal at LOW level, After the
Power supply stabilized, release the reset terminal(/RES = High)
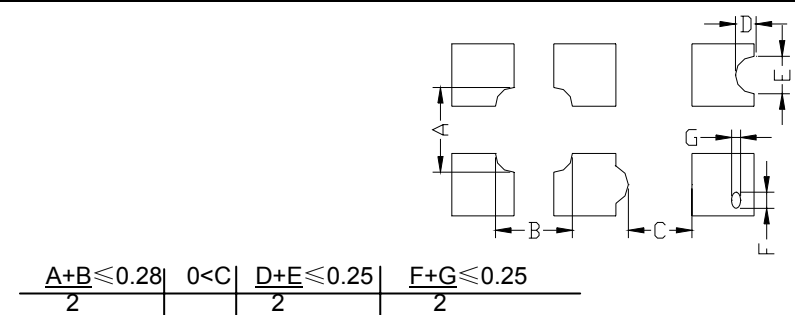
4.4   Display Commands

×: Don't care

Instruction	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Display ON / OFF	0	0	1	0	1	0	1	1	1	DON	Turn on/off LCD panel When DON = 0: display OFF When DON = 1: display ON
Initial display line	0	0	0	1	ST5	ST4	ST3	ST2	ST1	ST0	Specify DDRAM line for COM0
Set page address	0	0	1	0	1	1	P3	P2	P1	P0	Set page address
Set column address MSB	0	0	0	0	0	1	Y7	Y6	Y5	Y4	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y3	Y2	Y1	Y0	Set column address LSB
Read status	0	1	BUSY	ADC	ON/OFF	RESETB	0	0	0	0	Read the internal status
Write display data	1	0				Write data					Write data into DDRAM
Read display data	1	1				Read data					Read data from DDRAM
ADC select	0	0	1	0	1	0	0	0	0	ADC	Select SEG output direction When ADC = 0: normal direction (SEG0→SEG131) When ADC = 1: reverse direction (SEG131→SEG0)
Reverse display ON / OFF	0	0	1	0	1	0	0	1	1	REV	Select normal / reverse display When REV = 0: normal display When REV = 1: reverse display
Entire display ON / OFF	0	0	1	0	1	0	0	1	0	EON	Select normal/entire display ON When EON = 0: normal display. When EON = 1: entire display ON
LCD bias select	0	0	1	0	1	0	0	0	1	BIAS	Select LCD bias
Set modify-read	0	0	1	1	1	0	0	0	0	0	Set modify-read mode
Reset modify-read	0	0	1	1	1	0	1	1	1	0	release modify-read mode
Reset	0	0	1	1	1	0	0	0	1	0	Initialize the internal functions
SHL select	0	0	1	1	0	0	SHL	×	×	×	Select COM output direction When SHL = 0: normal direction (COM0→COM63) When SHL = 1: reverse direction (COM63→COM0)
Power control	0	0	0	0	1	0	1	VC	VR	VF	Control power circuit operation
Regulator resistor select	0	0	0	0	1	0	0	R2	R1	R0	Select internal resistance ratio of the regulator resistor
Set reference voltage mode	0	0	1	0	0	0	0	0	0	1	Set reference voltage mode
Set reference voltage register	0	0	×	×	SV5	SV4	SV3	SV2	SV1	SV0	Set reference voltage register
Set static indicator mode	0	0	1	0	1	0	1	1	0	SM	Set static indicator mode
Set static indicator register	0	0	×	×	×	×	×	×	S1	S0	Set static indicator register
Power save	-	-	-	-	-	-	-	-	-	-	Compound Instruction of display OFF and entire display ON

4.5 Basic Operating Sequence
Initialization Sequence

	A0	D7	D6	D5	D4	D3	D2	D1	D0	hex	Note
Code Function											**Note**
Turn on Power Supply VDD & VSS While maintaining /RES at LOW	-	-	-	-	-	-	-	-	-	-	-
Wait until power supply is stabilized	-	-	-	-	-	-	-	-	-	-	-
Release the /RES Reset Signal (/RES = High)	-	-	-	-	-	-	-	-	-	-	See AC Characteristics section for timing details
LCD Bias = 1/9	0	1	0	1	0	0	0	1	0	A2H	LCD Characteristics
ADC = Normal	0	1	0	1	0	0	0	0	0	A0H	No flip on x-direction (SEG)
SHL = Reverse	0	1	1	0	0	1	0	0	0	C0H	Flip on y- direction (COM)
Initial Display Line = 0	0	0	1	0	0	0	0	0	0	40H	i.e. Display RAM "Page 0-D0" Matched to top line of the LCD
Power Control Voltage Follower = OFF Voltage Regulator = OFF Voltage Converter = ON	0	0	0	1	0	1	1	0	0	2CH	Turn on the internal Voltage Converter and wait until VOUT stable
Delay 50ms	-	-	-	-	-	-	-	-	-	-	
Power Control Voltage Follower = OFF Voltage Regulator = ON Voltage Converter = ON	0	0	0	1	0	1	1	1	0	2EH	Turn on the internal Voltage Regulator and wait until VOUT stable
Delay 50ms	-	-	-	-	-	-	-	-	-	-	
Power Control Voltage Follower = ON Voltage Regulator = ON Voltage Converter = ON	0	0	0	1	0	1	1	1	1	2FH	Turn on the internal Voltage Follower and wait until VOUT stable
Delay 50ms	-	-	-	-	-	-	-	-	-	-	
Regulator Resistor Select	0	0	0	1	0	0	1	0	1	25H	Set the built-in resistor ratio to middle
Set Reference Voltage Mode	0	1	0	0	0	0	0	0	1	81H	Set to the middle of the range it may be adjused
Set Reference Voltage Resistor	0	0	0	1	0	0	0	0	0	25H	For achieving the best display contrast
Display ON	0	1	0	1	0	1	1	1	1	AFH	Turn on the LCD display
Set Page Address = 0	0	1	0	1	1	0	0	0	0	B0H	Specify the display data RAM page address to 00H
Set Column Address (Upper -4bit = 0)	0	0	0	0	1	0	0	0	0	10H	Specify the display data RAM column address to 00H
Set Column Address (Lower-4bit =4)	0	0	0	0	0	0	1	0	0	00H	
Write Display Data	1				Display Data						-
Write Other Display Data											

5. 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 Φ≤0.3 Ignore (note) 0.3<Φ≤0.45 3 0.45<Φ≤0.6 1 0.6<Φ 0	Minor
3) Black／White line	Length (mm) Width (mm) Acceptable number L≤10 W≤0.03 Ignore 5.0≤L≤10 0.03<W≤0.04 3 5.0≤L≤10 0.04<W≤0.05 2 1.0≤L≤10 0.05<W≤0.06 2 1.0≤L≤10 0.06<W≤0.08 1 L≤10 0.08<W follows 2) point defect Defects separate with each other at an interval of more than 20mm	Minor
4) Display pattern	 $$\frac{A+B}{2}\leq 0.28 \quad 0<C \quad \frac{D+E}{2}\leq 0.25 \quad \frac{F+G}{2}\leq 0.25$$ Note: 1) Up to 3 damages acceptable 2) Not allowed if there are two or more pinholes every three-fourth inch.	Minor
5) Spot-like contrast irregularity	Size Φ(mm) Acceptable Number Φ≤0.7 Ignore (note) 0.7<Φ≤1.0 3 1.0<Φ≤1.5 1 1.5<Φ 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 Φ≤0.4 Ignore (note) 0.4<Φ≤0.65 2 0.65<Φ≤1.2 1 1.2<Φ 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<Φ, N≥1 (2) 0.3<Φ≤0.45, N≥1, Φ: Average diameter of solder ball (unit: mm) (3) 0.5<L, N≥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

6. Handling Precautions

6.1 Mounting method

A panel of LCD module made by our company consists of two thin glass plates with polarizers that easily get damaged.

And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board (PCB), extreme care should be used when handling the LCD modules.

6.2 Cautions of LCD handling and cleaning

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

-Isopropyl alcohol

-Ethyl alcohol

-Trichlorotriflorothane

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

Do not use the following solvent:

-Water

-Ketene

-Aromatics

6.3 Caution against static charge

The LCD module use C-MOS LSI drivers. So we recommend you:

Connect any unused input terminal to V_{dd} or V_{ss}. Do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

6.4 Packaging

-Module employs 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 direct to sunshine or high temperature/humidity.

6.5 Caution for operation

-It is an indispensable condition to drive LCD module within the limits of the specified voltage since the higher voltage over the limits may cause the shorter life of LCD module.

-An electrochemical reaction due to DC (direct current) causes LCD undesirable deterioration so that the uses of DC (direct current) drive should be avoided.

-Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD module may show dark color in them. However those phenomena do not mean malfunction or out of order of LCD module, which will come back in the specified operating temperature.

6.6 Storage

In the case of storing for a long period of time, the following ways are recommended:

-Storage in polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with not desiccant.

-Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping the storage temperature range.

-Storing with no touch on polarizer surface by any thing else.

6.7 Safety

-It is recommendable to crash damaged or unnecessary LCD into pieces and to wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.

-When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well at once with soap and water.