

LCD MODULE SPECIFICATION FOR APPROVAL	DATE	02/01/07
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1. General Description

- 128 x 64 Dots STN Yellow-Green Transflective Dot Matrix LCD Graphic Module.
- Viewing Angle: 6 O'clock direction.
- Driving duty: 1/64 Duty, 1/9 bias.
- 'SAMSUNG' KS0107B 64-Channel LCD Common Driver or equivalent.
- 'SAMSUNG' KS0108B 64-Channel LCD Segment Drivers or equivalent.
- DC/DC converter.
- MPU interface.
- Power Supply: 5.0V+/-10%.
- FFC.
- Yellow-Green Backlight (Side LED).

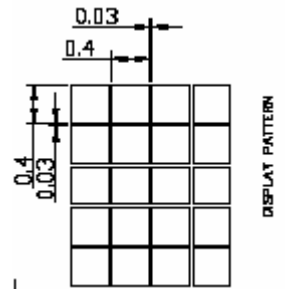
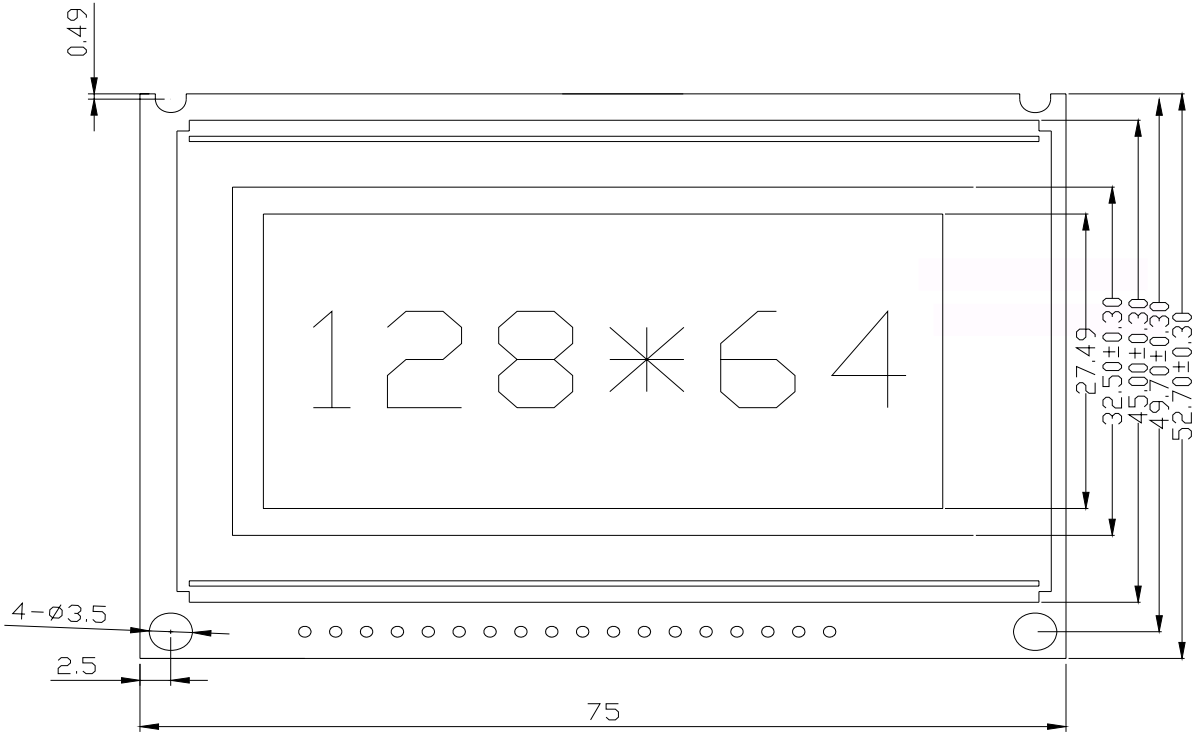
2. Mechanical Specifications

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Table 1

Parameter	Specifications	Unit
Outline dimensions	75(W) x 52.7(H) x 9.0MAX(D) (Exclude FFC) 125.0 (W) x 52.7(H) x 9.0MAX(D) (Include FFC)	mm
Viewing area	60.0 (W) x 32.5(H)	mm
Display format	128 x 64 dots	
Dot size	0.4(W) x 0.4(H)	mm
Dot spacing	0.03(W) x 0.03(H)	mm
Dot pitch	0.43(W) x 0.43(H)	mm
Weight:	TBD	grams

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PIN CONNECTION

NO	SYMBOL
1	VDD
2	VSS
3	V0
4	DB0
5	DB1
6	DB2
7	DB3
8	DB4
9	DB0
10	DB8
11	DB7
12	CS1
13	CS2
14	RESET
15	R/W
16	D/A
17	E
18	VEE
19	ANODE
20	CATHODE

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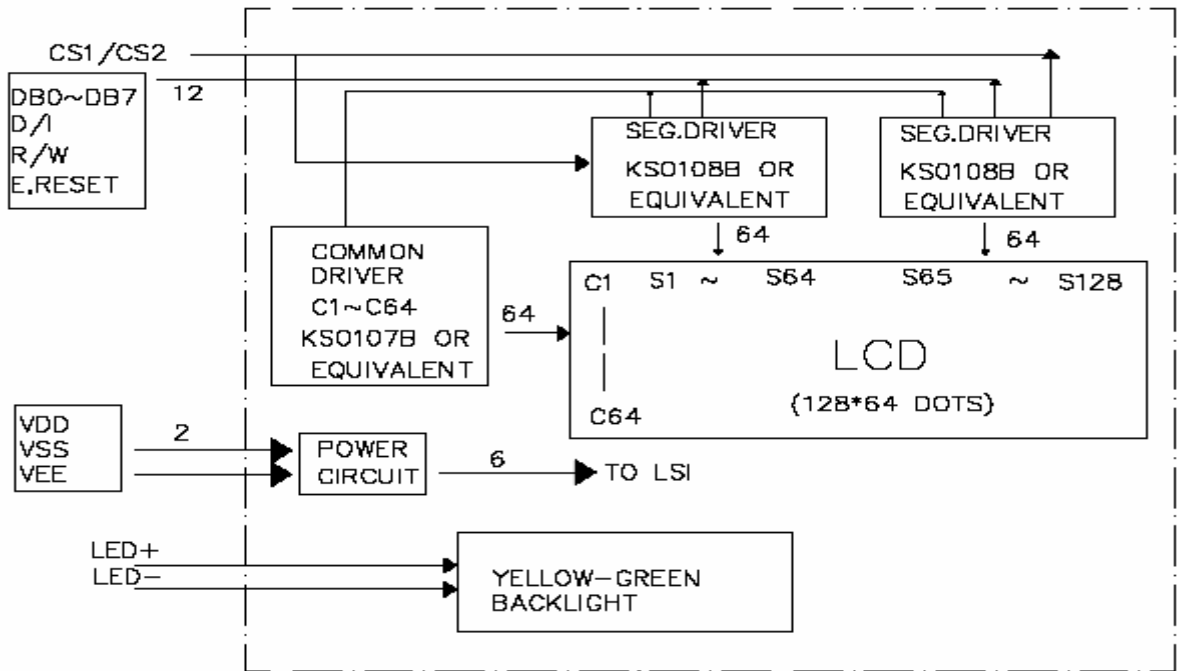


Figure 2: Block Diagram

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3. Interface signals

Table 2

Pin No.	Symbol	Description
1	VDD	Power supply for logic.
2	VSS	Ground (0V).
3	V0	Bias supply voltage terminals to drive the LCD.
4	DB0	Data bus.
5	DB1	
6	DB2	
7	DB3	
8	DB4	
9	DB5	
10	DB6	
11	DB7	
12	CS1	Chip selection.
13	CS2	Chip selection.
14	RESET	Reset signal.
15	R/W	Read or Write. R/W=H; Data appears at DB<0:7> and can be read by the CPU while E=H, CS1=L, CS2=L. R/W=L; Display data DB<0:7> can be written at falling of E when CS1=L, CS2=L.
16	D/I	Data or Instruction. D/I=H; DB<0:7>: Display RAM Data D/I=L; DB<0:7>: Instruction Data
17	E	Enable signal. Write mode (R/W=L); data of DB<0:7> is latched at the falling edge of E. Read mode (R/W=H); DB<0:7> appears the reading data while E is at high level.
18	VEE	For LCD driver circuit.
19	ANODE	Anode of LED backlight.
20	CATHODE	Cathode of LED backlight.

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4. Absolute Maximum Ratings

4.1 Electrical Maximum Ratings (Ta = 25 °C)

Table 3

Parameter	Symbol	Min.	Max.	Unit
Power Supply voltage (Logic)	VDD	-0.3	+7.0	V
Power Supply voltage	VEE	VDD-19.0	VDD+0.3	V
Power Supply voltage (LCD drive)	VLCD	VEE-0.3	VDD+0.3	V
	VB	-0.3	VDD+0.3	V

Note:

The modules may be destroyed if they are used beyond the absolute maximum ratings.

All voltage values are referenced to VSS = 0V.

4.2 Environmental Condition

Table 4

Item	Operating Temperature (Topr)		Storage Temperature (Tstg)		Remark
	Min.	Max.	Min.	Max.	
Ambient Temperature	-20°C	+70°C	-30°C	+80°C	Dry
Humidity	95% max. RH for Ta ≤ 40°C < 95% RH for Ta > 40°C				no condensation
Vibration (IEC 68-2-6) cells must be mounted on a suitable connector	Frequency: 10 ~ 55 Hz Amplitude: 0.75 mm Duration: 20 cycles in each direction.				3 directions
Shock (IEC 68-2-27) Half-sine pulse shape	Pulse duration: 11 ms Peak acceleration: 981 m/s ² = 100g Number of shocks: 3 shocks in 3 mutually perpendicular axes.				3 directions

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5. Electrical Specifications

5.1 Typical Electrical Characteristics

At $T_a = 25\text{ }^\circ\text{C}$, $V_{DD} = 5.5\text{V} \pm 0.2\text{V}$, $V_{SS} = 0\text{V}$.

Table 5

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage (Logic)	VDD-VSS		5.4	5.5	5.6	V
Supply voltage (LCD)	VLCD	VDD = +5.5V, Note 1	9.8	10.0	10.2	V
Input signal voltage For D/I, RESET, CS1, CS2, E, R/W, RS, DB0~DB7 pins.	V _{IH1}	“H” level	0.7VDD	-	VDD	V
	V _{IH2}		2.0		VDD	V
	V _{IL1}	“L” level	0	-	0.3VDD	V
	V _{IL2}		0		0.8	V
Supply Current (Logic & LCD)	IDD	Note 1	-	2.1	3.2	mA
Supply Voltage of Yellow-Green Backlight (Side LED)	VLBL	Forward current =90mA	4.0	4.2	4.4	V

Note 1: There is tolerance in optimum LCD driving voltage during production and it will be within the specified range.

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5.2 Timing Specifications

At Ta = -20 °C To +70 °C, VDD = +5.5V±0.2V, VSS = 0V.

Refer to Fig. 3 & Fig. 4, the bus timing diagram for MPU interface.

Table 6

Characteristic	Symbol	Min	Typ	Max	Unit
E Cycle	t_c	1000	-	-	ns
E High Level Width	t_{WH}	450	-	-	ns
E Low Level Width	t_{WL}	450	-	-	ns
E Rise Time	t_R	-	-	25	ns
E Fall Time	t_F	-	-	25	ns
Address Set-Up Time	t_{ASU}	140	-	-	ns
Address Hold Time	t_{AH}	10	-	-	ns
Data Set-Up Time	t_{DSU}	200	-	-	ns
Data Delay Time	t_D	-	-	320	ns
Data Hold Time (Write)	t_{DHW}	10	-	-	ns
Data Hold Time (Read)	t_{DHR}	20	-	-	ns

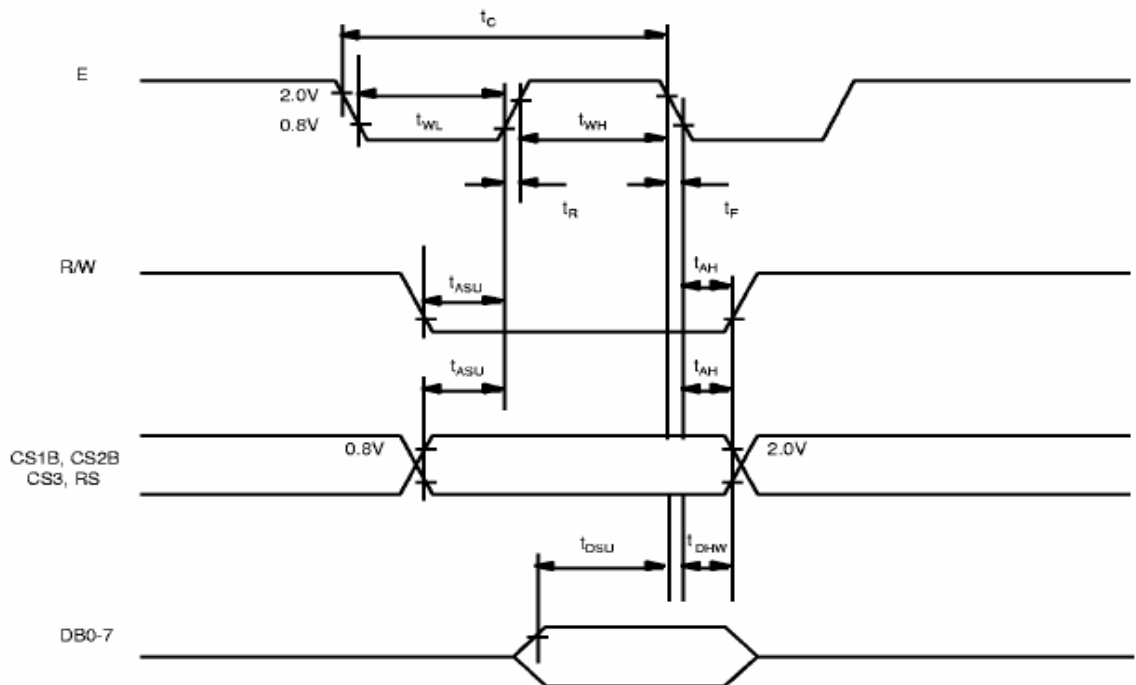


Figure 3: MPU write timing

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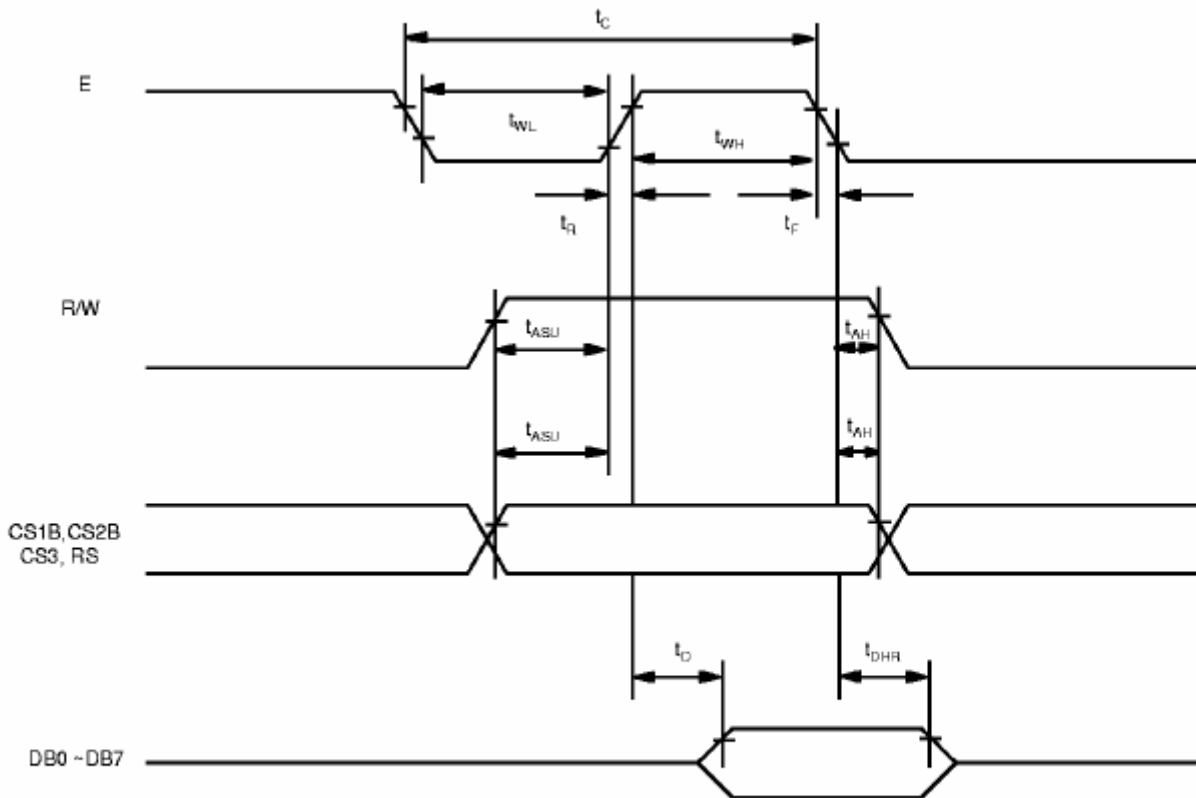


Figure 4: MPU read timing

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At $T_a = -20\text{ }^\circ\text{C}$ To $+70\text{ }^\circ\text{C}$, $V_{DD} = +5.5\text{V} \pm 0.2\text{V}$, $V_{SS} = 0\text{V}$.

Refer to Fig. 5, the bus timing diagram for reset timing.

Table 7

Item	Symbol	Min	Typ	Max	Unit
Reset Time	t_{RS}	1.0	-	-	μs
Rise Time	t_R	-	-	200	ns

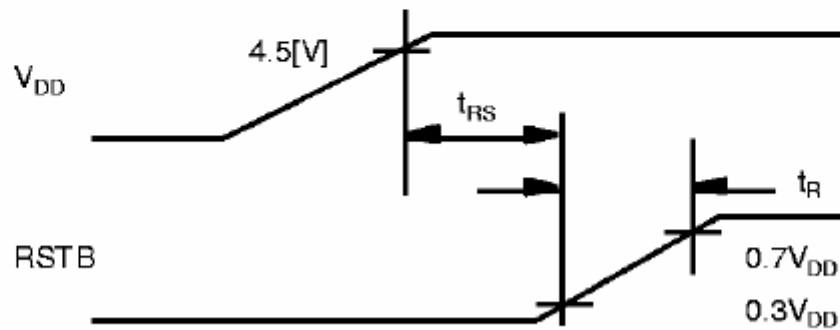


Figure 5: Reset Timing

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5.3 Instruction Table

Table 8

The display control instructions control the internal state of the KS0108B. Instruction is received from MPU to KS0108B for the display control. The following table shows various instructions.

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function	
Display ON/OFF	L	L	L	L	H	H	H	H	H	L/H	Controls the display on or off. Internal status and display RAM data is not affected. L:OFF, H:ON	
Set Address (Y address)	L	L	L	H	Y address (0~63)						Sets the Y address in the Y address counter.	
Set Page (X address)	L	L	H	L	H	H	H	Page (0~7)			Sets the X address at the X address register.	
Display Start Line (Z address)	L	L	H	H	Display start line (0~63)						Indicates the display data RAM displayed at the top of the screen.	
Status Read	L	H	B U S Y	L	O N / O F F	R E S E T	L	L	L	L	Read status. BUSY L: Ready H: In operation ON/OFF L: Display ON H: Display OFF RESET L: Normal H: Reset	
Write Display Data	H	L	Write Data									Writes data (DB0:7) into display data RAM. After writing instruction, Y address is increased by 1 automatically.
Read Display Data	H	H	Read Data									Reads data (DB0:7) from display data RAM to the data bus.

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6. Quality Units

6.1. Inspection conditions

6.1.1 The environment conditions for inspection shall be as follows:

Room temperature: $25\pm 5^{\circ}\text{C}$

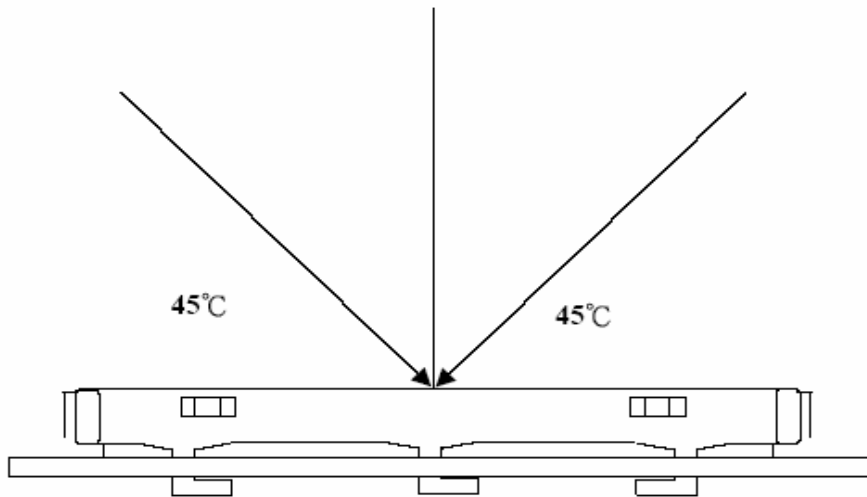
Humidity: $65\pm 20\%\text{RH}$

6.1.2 Manner of appearance test

6.1.2.1 The test must be under 20w X2 or 40w fluorescent light, and the distance of view must be at 30 ± 5 cm.

6.1.2.2 When test the model of transmissive product must add the reflective plate.

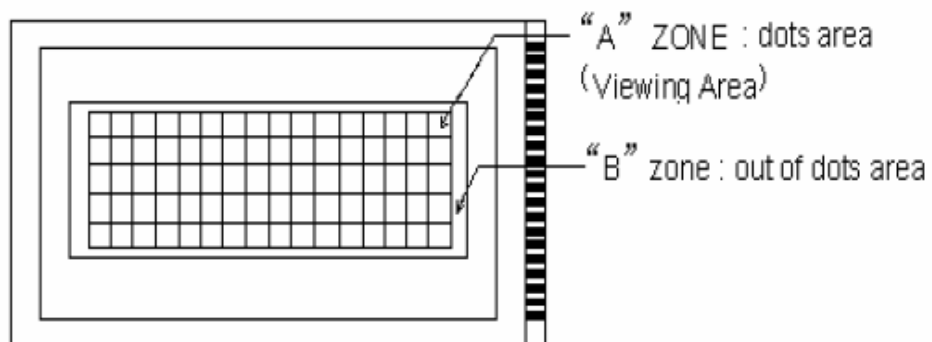
6.1.2.3 The test direction is base on about around 45° of vertical line.



6.1.2.4 Definition of area:

A area: dots area.

B area: out of dots area (outside dots area).



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6.2. Sampling procedures for each item's acceptance level table

Defect type	Sampling procedures	AQL
Major defect	GB2828-87 single sampling plans for normal inspection	0.65
Minor defect	GB2828-87 single sampling plans for normal inspection	1.50

6.3. Classification of defects

6.3.1 Major defect

A major defect refers to a defect that is considered to substantially degrade usability for product applications.

6.3.2 Minor defect

A minor defect refers to a defect that is not considered to substantially degrade product application, or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation

6.4. Basic sampling principle

6.4.1 It will accord to the AQL when the standard can not be described.

6.4.2 The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.

6.4.3 Must add new item on time when it is necessary.

6.5. Nonconforming analysis and Deal With Manner

6.5.1 Nonconforming analysis

6.5.1.1 Customer should supply the detail data of nonconforming sample and the unsuitable sample.


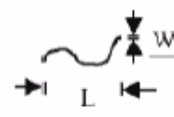
6.5.1.2 After accepting the detail data from the customer, the analysis of nonconforming should be finished in two weeks.

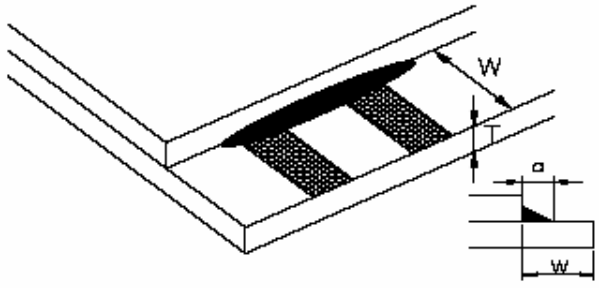
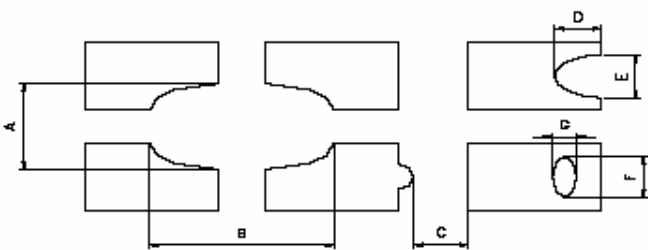
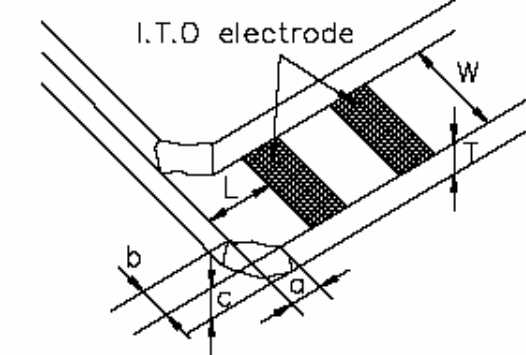
6.5.2 Disposition of nonconforming

Both supplier and customer should analyze the reason together and discuss the disposition of nonconforming when the reason of nonconforming is not sure.

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6.6 Standard of inspection (unit: mm)

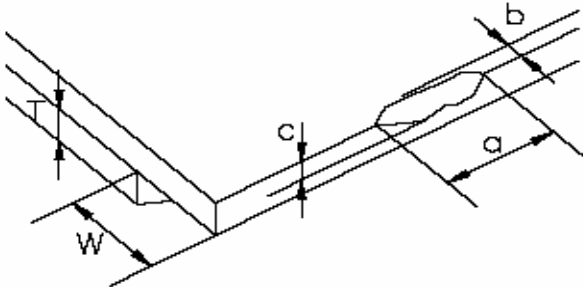
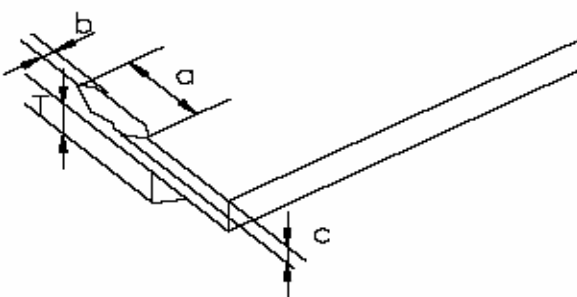
NO	Items	Criterion of defects			AQL
01	Electrical testing	1.Display missing, Short-circuit; 2.No display, display malfunction; 3.Current consumption exceeds product specifications; 4.LCD viewing angle fault; 5.Mixed wrong type products; 6.Contrast fault.			Minor
02	Black or white spots on LCD (display only)	1.White or black spots on display should be less than (\cong) 0.25mm on display 2.No more than 3 white or black spots present. 3.No more than 2 spots or lines within 3mm.			Minor
03	Black or white spots (non-display) Contamination (non-display)	$D=(A+B)/2$ 	Size D	Acceptable number	Minor
			$D \leq 0.15$	Ignore	
			$0.15 < D \leq 0.20$	3	
			$0.20 < D \leq 0.25$	2	
			$0.25 < D \leq 0.30$	1	
04	Dark lines and scratches 	Width	Length	Acceptable number	Minor
		$W \leq 0.03$	$L \leq 3.00$	3	
		$0.03 < W \leq 0.05$	$L \leq 2.00$	2	
		$0.05 < W \leq 0.08$	$L \leq 2.00$	1	
		$0.08 < W \leq 0.10$	$L \leq 3.00$	0	
		$W > 0.10$	$L > 3.00$	0	
05	Bubble in polarizer	Size D	Acceptable number		Minor
		$D \leq 0.20$	Ignore		
		$0.20 < D \leq 0.40$	3		
		$0.40 < D \leq 0.60$	2		
		$0.60 < D$	0		

06	Glass rest		Minor								
		$a \leq 1/4W$									
07	Display Pattern	 <p>1. Dot type (unit: mm) $(A+B)/2 \leq 0.25$ $C \geq 0$ $(D+E)/2 \leq 0.25$ $(F+G)/2 \leq 0.25$ Note: (1) Acceptable up to 3 damages. (2) If there're two or more pinholes per digit, it is rejected.</p>									
08	Chip in corner	 <table border="1" data-bbox="456 1475 1185 1666"> <thead> <tr> <th>a</th> <th>b</th> <th>c</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td>$a < 4\text{mm}$</td> <td>$b \leq W$</td> <td>$C \leq T$</td> <td>3</td> </tr> </tbody> </table>	a	b	c	Acceptable number	$a < 4\text{mm}$	$b \leq W$	$C \leq T$	3	Minor
a	b	c	Acceptable number								
$a < 4\text{mm}$	$b \leq W$	$C \leq T$	3								

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09	Chip in seal area					Minor
		a	b	c	Acceptable number	
		$a < 3\text{mm}$	$b \leq 1.5\text{mm}$	$c \leq 1/2T$	3	
		Chip is not acceptable if c is greater than 50% of the glass thickness or the seal area is damaged.				
10	Chip in pad (1)					
		a	b	c	Acceptable number	
		$a \leq 2\text{mm}$	$b \leq W/4$	$c \leq T$	Ignore	
		$a \leq 3\text{mm}$	$b \leq W/4$	$c \leq T$	3	

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11	Chip in pad (2)				Minor	
		a	b	c		Acceptable number
		$a \leq 2\text{mm}$	$b \leq W/3$	$c \leq T$		Ignore
		$a \leq 4\text{mm}$	$b \leq W/2$	$c \leq T$		3
12	Chip in other sides				Minor	
		a	b	b		Acceptable number
		$a \leq 3\text{mm}$	$b \leq 1\text{mm}$	$c \leq T$		Ignore
		$a \leq 4\text{mm}$	$b \leq 1.5\text{mm}$	$c \leq T$		3
13	Backlight	<p>1.Lumination source flickers. 2.Using spot, lines and contamination standard of LCD to judge the spots or scratches defect on backlight. 3.Not allow unlighted on backlight. 4.Colour and luminance of backlight should correspond its specification.</p>			Major Minor Major Major	

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14	PCB, COB	1. COB seal may not have pinholes larger than 0.2mm or contamination.	Minor
		2. COB seal surface may not have pinholes through to the IC.	Minor
		3. The height of the COB should not exceed.	Minor
		4. Beyond 2mm of the seal area, there may not have sealant on the PCB, and the sealant should be no more than three places.	Minor
		5. No oxidation or contamination on PCB connector.	Minor
		6. Parts on PCB should correspond the characteristic, and not allow wrong parts, missing parts or additional parts.	Major
		7. The jumper on the PCB should correspond to the characteristic.	Minor
		8. The solder which gets on bezel, LED pad, zebra pad or screw hole pad should be smoothed down.	Major
15	Soldering	1. No unmelted solder pastes on the PCB.	Minor
		2. No cold solder joints, solder connection missing, oxidation of solder.	Minor
		3. No short circuits in components on PCB.	Minor
16	General Appearance	1. No oxidation, contamination, curves or bends on interface Pin of TCP.	Major
		2. No cracks on interface pin of TCP.	Minor
		3. No solder residue or solder balls on product.	Minor
		4. The IC on the TCP may not be damaged.	Minor
		5. The top edge of the protective strip on the interface pin must be present or look as if it causes the interface pin to sever.	Minor
		6. The residual rosin or tin oil of soldering (component or chip component) is not turned into brown or black color.	Minor
		7. Sealant on top ITO circuit is not hard.	Major
		8. Pin type must correspond the specification.	Major
		9. LCD pin loose or pin missing.	Major
		10. Packing method correspond the specification.	Major
		11. Dimension and structure correspond the specification sheet.	Major
		12. No dirt and break on the heat seal.	Major

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6.7 Standard specification for reliability of LCD Module

ITEM	Condition	Criterion
High temperature operation	+70°C 24h	Total current consumption should be below double of initial value. Cosmetic defects should not be happened.
Low temperature operation	-20°C 8h	
Humidity (without polarizer)	40°C 90%RH 240h	
High temperature storage	+80°C 16h	
Low temperature storage	-30°C 8h	
Thermal shock storage	-20°C→25°C→70°C→25°C 30min→5min→30min→5min 5 cycle	
Vibration (Package state)	10~150Hz 5m/s ² 45min	
Falling test (Packaged state)	1000mm	

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7 Handling Precaution

1. Limitation of Application:

Itron products are designed for use in ordinary electronic devices such as business machines, telecommunications equipment, measurement devices and etc. Please handle the products with care. (see below)

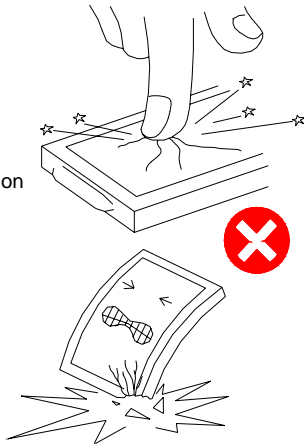
Itron products are not designed, intended, or authorized for use in any application which the failure of the product could result in a situation where personal injury or death may occur. these applications include, but are not limited to. life-sustaining equipment, nuclear control devices, aerospace equipment, devices related to hazardous or flammable materials, etc. [If Buyer intends to purchase or use the Itron Products for such unintended or unauthorized applications, Buyer must secure prior written consent to such use by a responsible officer of Itron Corporation.] Should Buyer purchase or use Itron Products for any such unintended or unauthorized application [without such consent]. Buyer shall indemnify and hold Itron and its officers, employees, subsidiaries, affiliates and distributors harmless against all claims, costs, damages and expenses, and reasonable attorney's fees, arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Itron was negligent regarding the design or manufacture of the part.

2. Industrial Rights and Patents

Itron shall not be responsible for any infringement of industrial property rights of third parties in any country arising out of the application or use of Itron products, except which directly concern the structure or production of such products.

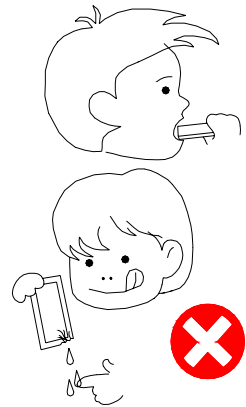
No Press and Shock!

If pressure to LCD, orientation may be disturbed.
LCD will broken by shock!



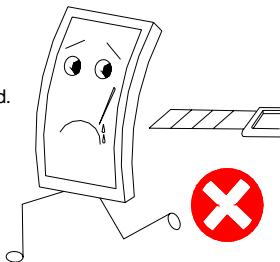
Don't Swallow or Touch Liquid Crystal!

Liquid Crystal may be leaked when display is broked.
If it accidentally gets your hands, wash then with water!



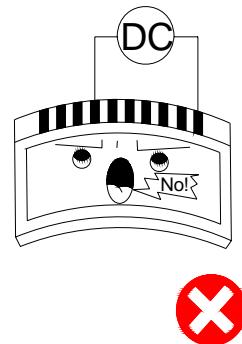
Don't not Scratch!

Polarizer is a soft material and can easily be scratched.



No DC Voltage to LCD!

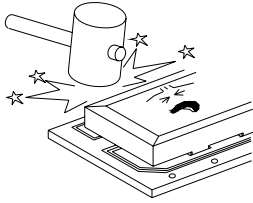
DC volrage or driving higher than the specified voltage will reduce the lifetime of the LCD.



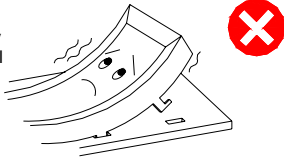
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Don't Press the Metallic Frame and Disassemble the LCM

Pressure on the metallic frame and PCB may deform the conductive rubber or break the liquid crystal cell and back light, which will cause defects.

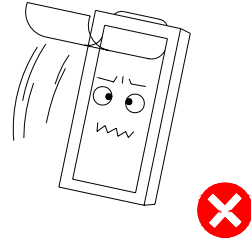


LCD may be shifted or conductive rubber may be reshaped, which will cause defects.



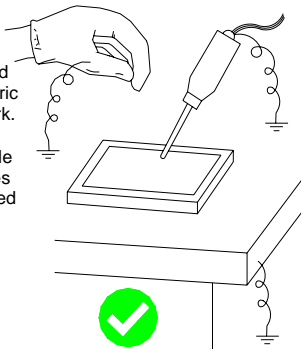
Slowly Peel Off Protective Film!

Avoid static electricity.



Avoid Static Electricity!

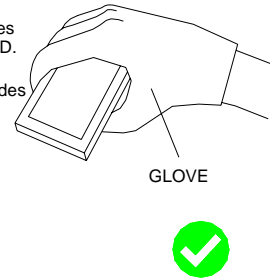
Please be sure to ground human body and electric appliances during work. It is preferable to use conductive mat on table and wear cotton clothes or conduction processed fiber. Synthetic fiber is not recommended.



Wear Gloves While Handling!

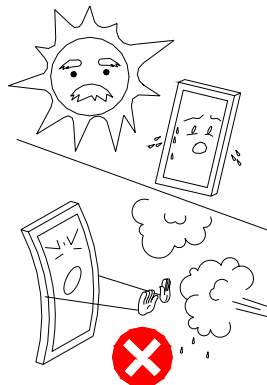
It is preferable to wear gloves to avoid damaging the LCD.

Please do not touch electrodes with bare hands or make them dirty.



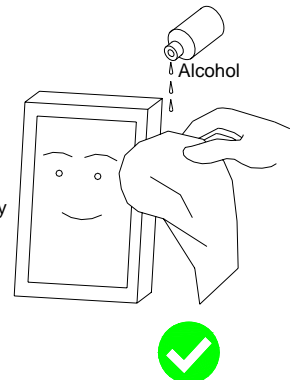
Keep Away From Extreme Heat and Humidity!

LCD deteriorates.



Use Alcohol to Clean Terminals!

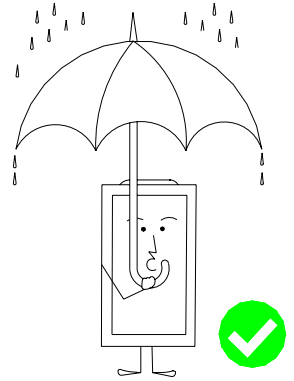
When attaching with the heat seal or anisotropically conductive film, wipe off with alcohol before use.



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Don't Drop Water on LCD!

Note that the presence of waterdrops or dew in the LCD panel may deteriorate the polarizer or corrode electrode.



Precaution in Soldering LCD Module

Basic instructions: Solder I/O terminals only.

Use soldering iron without leakage.

(1) Soldering condition to I/O terminals

Temperature at tip of the iron: $280 \pm 10^\circ\text{C}$

Soldering time: 3~4 sec.

Type of solder: Eutectic solder (containing colophony-flux)

*Please do not use flux because it may soak into LCD Module or contaminate it.

*It is preferable to peel off protective film on display surface after soldering I/O terminals is finished.

(2) Remove connector or cable

*When you remove connector or cable soldered to I/O terminals, please confirm that solder is fully melted. If you remove by force, electrodes at I/O terminals may be damaged (or stripped off).

*It is recommended to use solder suction machine.

Long-term Storage

If it is necessary to store LCD modules for a long time, please comply with the following procedures.

If storage condition is not satisfactory, display (especially polarizer) may be deteriorated or soldering I/O terminals may become difficult (some oxide is generated at I/O terminals plating).

1. Store as delivered by Optrex

2. If you store as unpacked, put in anti-static bag, seal its opening and store where it is not subjected to direct sunshine nor fluorescent lamp.

3. Store at temperature 0 to $+35^\circ\text{C}$ and at low humidity. Please refer to our specification sheets for storage temperature range and humidity condition.

Long-term Storage

Please use power supply with built-in surge protection circuit.