SHENZHEN XINGYUHE CO.,LTD

SPECIFICATIONS

CUSTOMER :

PRODUCT : LCD Module

SAMPLE　CODE : JBC1602A00-08W

VER : 00

Customer Approved	Confirmed	Designer

History of Version

Date	Ver.	Description	Page	Design by
2006/12/12	0	New Sample.	-	

CONTENT

1. SPECIFICATIONS

1.1 Features

Item	Standard Value
Display Type	16 (Character) *2(ROW)
LCD Type	STN(BLUE),Transmissive/Negative.
Driver Condition	1/16Duty , 1/5Bias
Viewing Direction	6 O'clock
Backlight Type	BLUE
Interface	8Bits data bus
Driver IC	SPLC780D,EQUST7066U

1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	80.0(L) * 36.3 (W) * 14.0(H)(Max)	mm
Viewing Area	64.3(L) *16.3(W)	mm
Active Area	57.66(L) * 9.4(W)	mm
Dots Size	0.55(L) * 0.50 (W)	mm
Dots Pitch	0.60(L) * 0.55(W)	mm
Character Size	2.91(L) * 4.35(W)	mm
Character Pitch	3.65(L) * 5.05(W)	mm

1.3 Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit
System Power Supply Voltage	VDD	-	-0.3	5.5	V
LCD Driver Supply Voltage	$VOUT_{IN}$	-	VDD-12.0	VDD+0.3	V
Input Voltage	V_{IN}	-	-0.3	VDD + 0.3	V
Operating Temperature	T_{OP}	-	-20	70	°C
Storage Temperature	T_{ST}	-	-30	80	°C
Storage Humidity	H_D	Ta < 40 °C	20	90	%RH

1.4   DC Electrical Characteristic

VDD = 5.0V ± 0.2V , GND = 0V , Ta = 25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage	VDD	-	4.5	5.0	5.5	V
Input High Voltage	V_{IH}	-	0.8VDD	-	VDD	V
Input Low Voltage	V_{IL}	-	GND	-	0.3VDD	V
Output High Voltage	V_{OH}	-	0.7VDD	-	VDD	V
Output Low Voltage	V_{OL}	-	GND	-	0.2VDD	V
LCD Driver Voltage	V_{OP}	VOP –GND (0°C)	4.8	5.0	5.2	V
		VOP -GND (25°C)	4.6	4.7	4.8	
		VOP -GND (40°C)	4.4	4.5	4.6	

2. MODULE STRUCTURE

2.1   Counter Drawing

2.1.1   LCM Mechanical Diagram

PIN NO.	SYMBOL
1	VSS
2	VDD
3	V0
4	RS
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A
16	K

SPECIFICATIONS

STORAGE TEMP :   −30°C TO +80°C
OPERATING TEMP :   −20C TO +70°C
VIEWING DIRECTION : 6 O'CLOCK
DRIVE CONDITION : 1/16 DUTY, 1/5 BIAS, VLCD= 4.7V
DISPLAY MODE :   STN(BLUE) TRANSMISSIVE NEGATIVE MODE
BACK LIGHT ITEM: WHITE SIDE 2PCS   3.0V
LCM OPERATING VOLTAGE:5.0V
CONTROLLER/DRIVER IC: ST7066U

C/D 外型图

深圳市兴宇合电子有限公司

MODEL NUMBER :
JBC1602A00-08W

PART No:

PROJECTION

DO NOT SCALE THIS DRAWING.

DESCRIPTION:

SCALE: FIT

SHEET: 1 OF 1

GENERAL TOL: UNIT
± 0.20mm   mm

APPROVALS   DATE
APP:
CHK:
DWN: zqs   2010.0806

REV	DESCRIPTION:	DATE
A00	First issue	2010.08.06

2.1.2 Block Diagram

2.2 Interface Pin Description

Pin No.	Symbol	Function
1	VSS	Ground
2	VDD	Power supply input for driver IC (+5.0V).
3	V0	LCD operation voltage test pin.
4	RS	Data and control register select input H : D0 to D7 are display data. L : D0 to D7 are control data.
5	R/W	Write signal input, active " L
6	E	A start signal for reading or writing data
7	DB0	Data bus bit 0
8	DB1	Data bus bit 1
9	DB2	Data bus bit 2
10	DB3	Data bus bit 3
11	DB4	Data bus bit 4
12	DB5	Data bus bit 5
13	DB6	Data bus bit 6
14	DB7	Data bus bit 7
15	LED_A	BACKLIGHT POSITIVE
16	LED_K	BACKLIGHT NEGATIVE

2.3 Timing Characteristics

◆**AC Characteristics**(Vdd=5V±10%,Vss=0V Ta=25℃)

Internal clock operation

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
OSC Frequency	F_{OSC1}	190	270	350	KHz	VDD = 3.0V, Rf = 75KΩ±2%

External clock operation

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
External Frequency	F_{OSC2}	125	250	350	KHz	
Duty Cycle		45	50	55	%	
Rise/Fall Time	t r, t f	-	-	0.2	μs	

Write mode

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
E Cycle Time	t_C	1000	-	-	ns	Pin E
E Pulse Width	t_{PW}	450	-	-	ns	Pin E
E Rise/Fall Time	t_R, t_F	-	-	25	ns	Pin E
Address Setup Time	t_{SP1}	60	-	-	ns	Pins: RS, R/W, E
Address Hold Time	t_{HD1}	20	-	-	ns	Pins: RS, R/W, E
Data Setup Time	t_{SP2}	195	-	-	ns	Pins: DB0 - DB7
Data Hold Time	t_{HD2}	10	-	-	ns	Pins: DB0 - DB7

Read mode

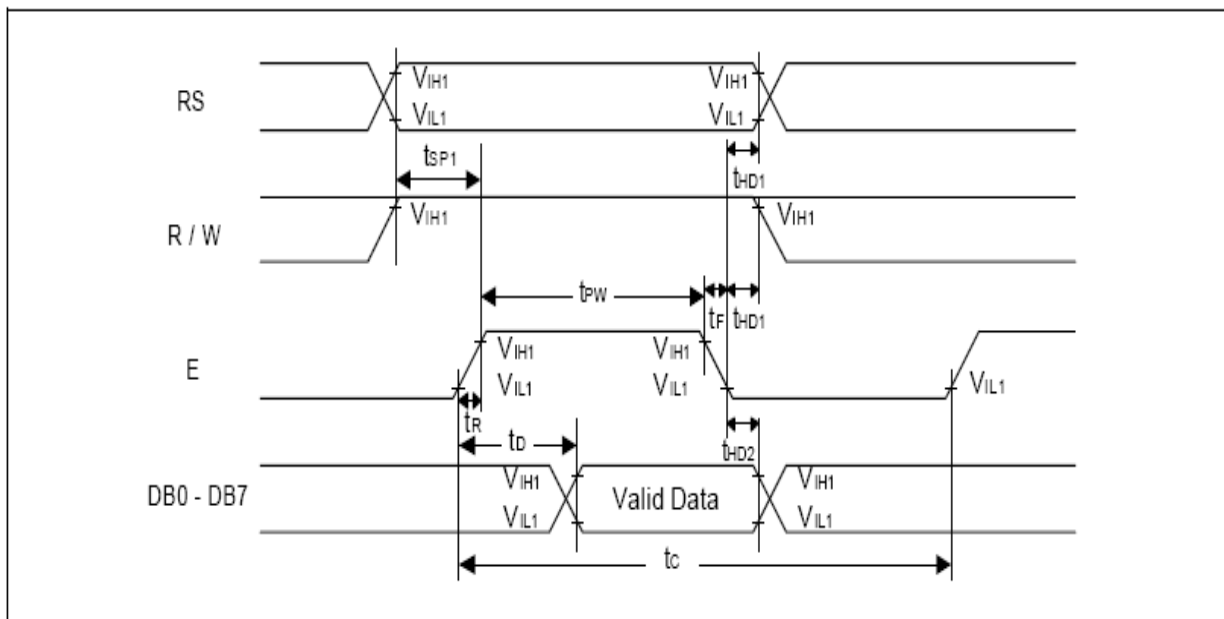| Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
E Cycle Time	t_C	1000	-	-	ns	Pin E
E Pulse Width	t_W	450	-	-	ns	Pin E
E Rise/Fall Time	t_R, t_F	-	-	25	ns	Pin E
Address Setup Time	t_{SP1}	60	-	-	ns	Pins: RS, R/W, E
Address Hold Time	t_{HD1}	20	-	-	ns	Pins: RS, R/W, E
Data Output Delay Time	t_D	-	-	360	ns	Pins: DB0 - DB7
Data hold time	t_{HD2}	5.0	-	-	ns	Pin DB0 - DB7

• Timing Chart

Write mode timing   diagram for the   MPU
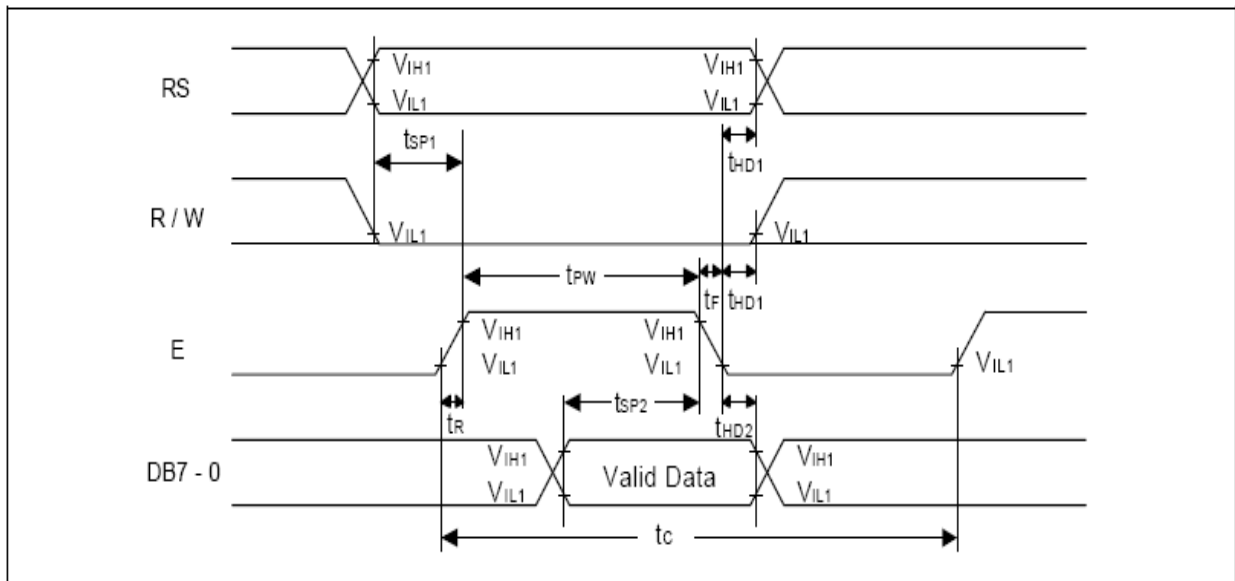
° Read mode timing   diagram for the   MPU
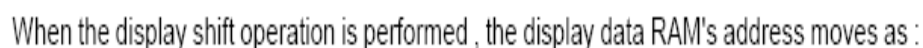
2.4 Instruction Table

■ **DISPLAY COMMANDS**

No.	Instruction	Display	Operation
1	Power on.		Power on reset. No display.
2	Function set RS R/W DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0 0 0 0 0 1 1 1 0 X X		Set to 8-bit operation and select 2-line display line and 5 x 8 dot character font.
3	Display on / off control 0 0 0 0 0 0 1 1 1 0	_	Display on. Cursor appear.
4	Entry mode set 0 0 0 0 0 0 0 1 1 0	_	Increase address by one. It will shift the cursor to the right when writing to the DD RAM / CG RAM. Now the display has no shift.
5	Write data to CG RAM / DD RAM 1 0 0 1 0 1 0 1 1 1	W_	Write " W ". The cursor is incremented by one and shifted to the right.
6	:	:	:
7	Write data to CG RAM / DD RAM 1 0 0 1 0 0 0 1 0 1	WELCOME_	Write " E ". The cursor is incremented by one and shifted to the right.
8	Set DD RAM address 0 0 1 1 0 0 0 0 0 0	WELCOME _	It sets DD RAM's address. The cursor is moved to the beginning position of the 2nd line.
9	Write data to CG RAM / DD RAM 1 0 0 1 0 1 0 1 0 0	WELCOME T_	Write " T ". The cursor is incremented by one and shifted to the right.
10	:	:	:
11	Write data to CG RAM / DD RAM 1 0 0 1 0 1 0 1 0 0	WELCOME TO PART_	Write " T ". The cursor is incremented by one and shifted to the right.

No.	Instruction	Display	Operation
12	Entry mode set 0 0 0 0 0 0 0 1 1 1	WELCOME TO PART_	When writing, it sets mode for the display shift.
13	Write data to CG RAM / DD RAM 1 0 0 1 0 1 1 0 0 1	ELCOME O PARTY_	Write " Y ". The cursor is incremented by one and shifted to the right.
14	:	:	:
15	Return home 0 0 0 0 0 0 0 0 1 0	WELCOME TO PARTY	Both the display and the cursor return to the original position (address 0).

Display Data RAM (DD RAM)
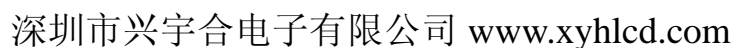
The 80-bit DD RAM is normally used for storing display data. Those DD RAM not used for display data can be used as general data RAM. Its address is configured in the Address Counter.

The relationships between Display Data RAM Address and LCD's position are depicted as follows.

1-line display , 80 display characters

1	2	3	4	5	6		79	80	← Display position
00	01	02	03	04	05	– – – – – – – – – –	4E	4F	← Display data RAM address

(Example) 1-line display , 8 display characters

1	2	3	4	5	6	7	8	← Display position
00	01	02	03	04	05	06	07	← Display data RAM address

When the display shift operation is performed , the display data RAM's address moves as :

(i) Left shift

01	02	03	04	05	06	06	07	08

(ii) Right shift

4F	00	01	02	03	04	05	06
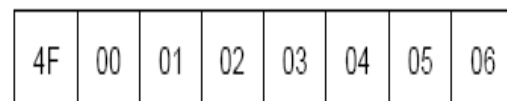
Timing Generation Circuit

The timing generating circuit is able to generate timing signals to the internal circuits. In order to prevent the internal timing interface, the MPU access timing and the RAM access timing are generated independently.

LCD Driver Circuit

Total of 16 commons and 40 segments signal drivers are valid in the LCD driver circuit. When a program specifies the character fonts and line numbers, the corresponding common signals output drive-waveforms and the others still output unselected waveforms.

Character Generator ROM (CG ROM)

Using 8-bit character code, the character generator ROM generates 5 x 8 dots or 5 x 10 dots character patterns. It also can generate 192's 5 x 8 dots character patterns and 64's 5 x 10 dots character patterns.

Character Generator RAM (CG RAM)

Users can easily change the character patterns in the character generator RAM through program. It can be written to 5 x 8 dots, 8-character patterns or 5 x 10 dots for 4-character patterns.

The following diagram shows the SPLC780D character patterns:

Correspondence between Character Codes and Character Patterns.

5 x 8 dot character patterns

Character Code (DD RAM Data)								CG RAM Address						Character Patterns (CG RAM Data)								
b7	b6	b5	b4	b3	b2	b1	b0	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	
											0	0	0				1	1	1	1	1	
											0	0	1				0	0	1	0	0	
											0	1	0				0	0	1	0	0	Character Pattern Example (1)
											0	1	1				0	0	1	0	0	
0	0	0	0	X	0	0	0	0	0	0	1	0	0	X	X	X	0	0	1	0	0	
											1	0	1				0	0	1	0	0	
											1	1	0				0	0	1	0	0	Cursor Position
											1	1	1				0	0	0	0	0	
											0	0	0				0	1	1	1	0	
											0	0	1				0	0	1	0	0	
											0	1	0				0	0	1	0	0	Character Pattern Example (2)
											0	1	1				0	0	1	0	0	
0	0	0	0	X	0	0	1	0	0	1	1	0	0	X	X	X	0	0	1	0	0	
											1	0	1				0	0	1	0	0	
											1	1	0				0	1	1	1	0	
											1	1	1				0	0	0	0	0	

Total of 16 commons and 40 segments signal drivers are valid in the LCD driver circuit. When a program specifies the character fonts and line numbers, the corresponding common signals output drive-waveforms and the others still output unselected waveforms.

Users can easily change the character patterns in the character generator RAM through program. It can be written to 5 x 8 dots, 8-character patterns or 5 x 10 dots for 4-character patterns.

Cursor/Blink Control Circuit

This circuit generates the cursor or blink in the cursor / blink control circuit. The cursor or the blink appears in the digit at the Display Data RAM Address defined in the Address Counter.

When the Address Counter is (07) 16, the cursor position is shown as belows:
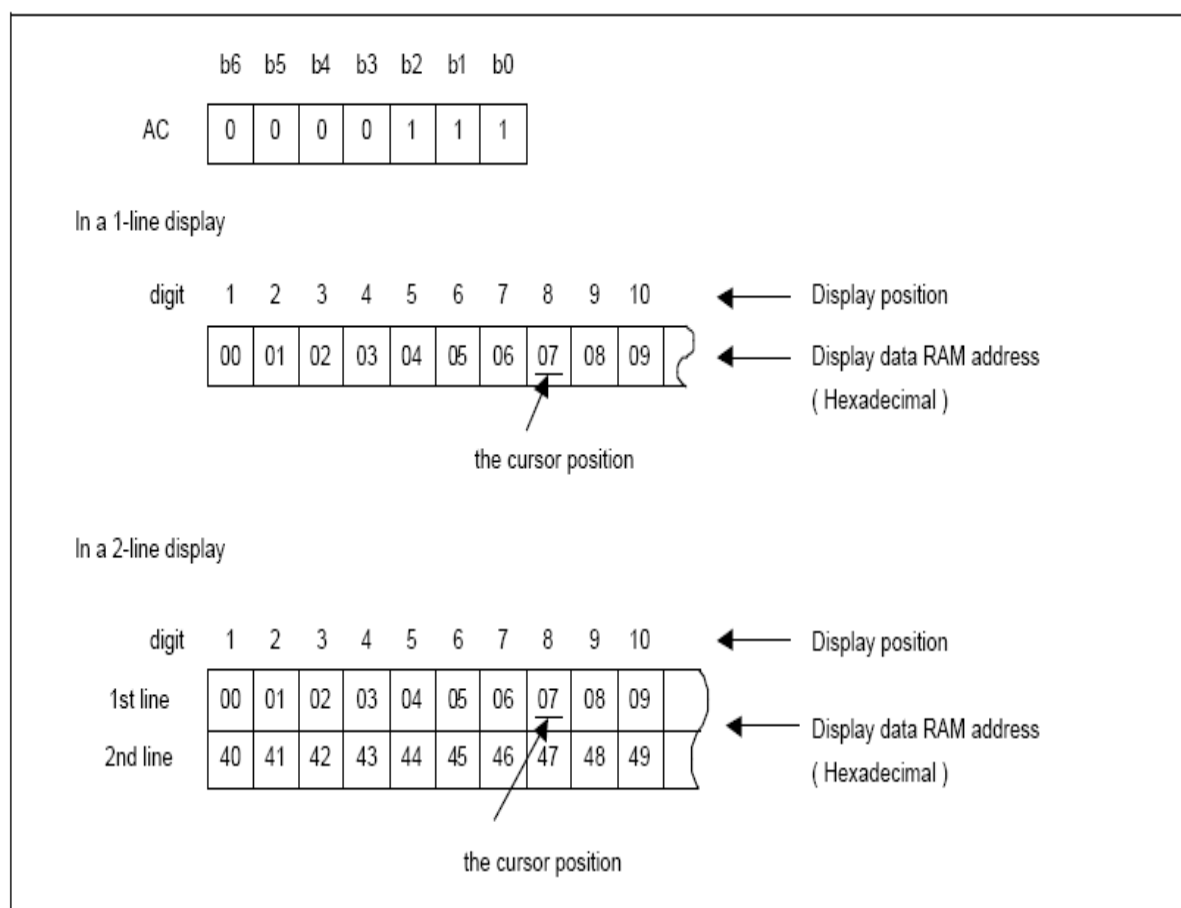
Interfacing to MPU

There are two types of data operations: 4-bit and 8-bit operations. Using 4-bit MPU, the interfacing 4bit data is transferred by 4-busline (DB4 to DB7). Thus, DB0 to DB3 bus lines are not used. Using 4-bit MPU to interface 8-bit data requires two times transferring. First, the higher 4-bit data is transferred by 4-busline (for 8-bit operation, DB7 to DB4). Secondly, the lower 4-bit data is transferred by 4-busline (for 8-bit operation, DB3 to DB0). For 8-bit MPU, the 8-bit data is transferred by 8-buslines (DB0 to DB7).

Supply Voltage for LCD Drive

Different voltages can be supplied to SPLC780D's pins (V5 - 1) for obtaining LCD drive-waveform. The relationships between bias, duty factor and supply voltages are shown as belows:

Duty Factor Supply Voltage	1/8, 1/11	1/16
	1/4	1/5
V1	$VDD - 1/4\ V_{LCD}$	$VDD - 1/5\ V_{LCD}$
V2	$VDD - 1/2\ V_{LCD}$	$VDD - 2/5\ V_{LCD}$
V3	$VDD - 1/2\ V_{LCD}$	$VDD - 3/5\ V_{LCD}$
V4	$VDD - 3/4\ V_{LCD}$	$VDD - 4/5\ V_{LCD}$
V5	$VDD - V_{LCD}$	$VDD - V_{LCD}$
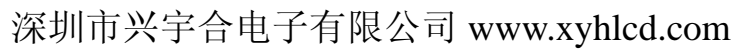
Cursor/Blink Control Circuit

This circuit generates the cursor or blink in the cursor / blink control circuit. The cursor or the blink appears in the digit at the Display Data RAM Address defined in the Address Counter.

When the Address Counter is (07) 16, the cursor position is shown as belows:
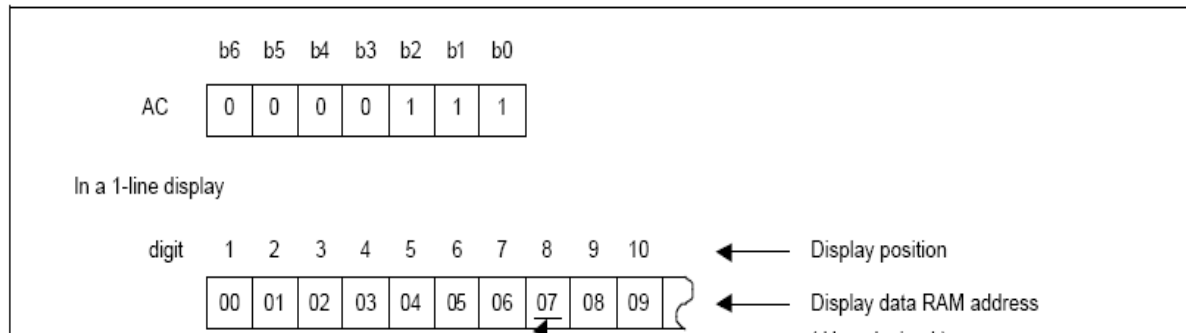
The power connections for LCD (1/4 Bias, 1/5 Bias) are shown belows:
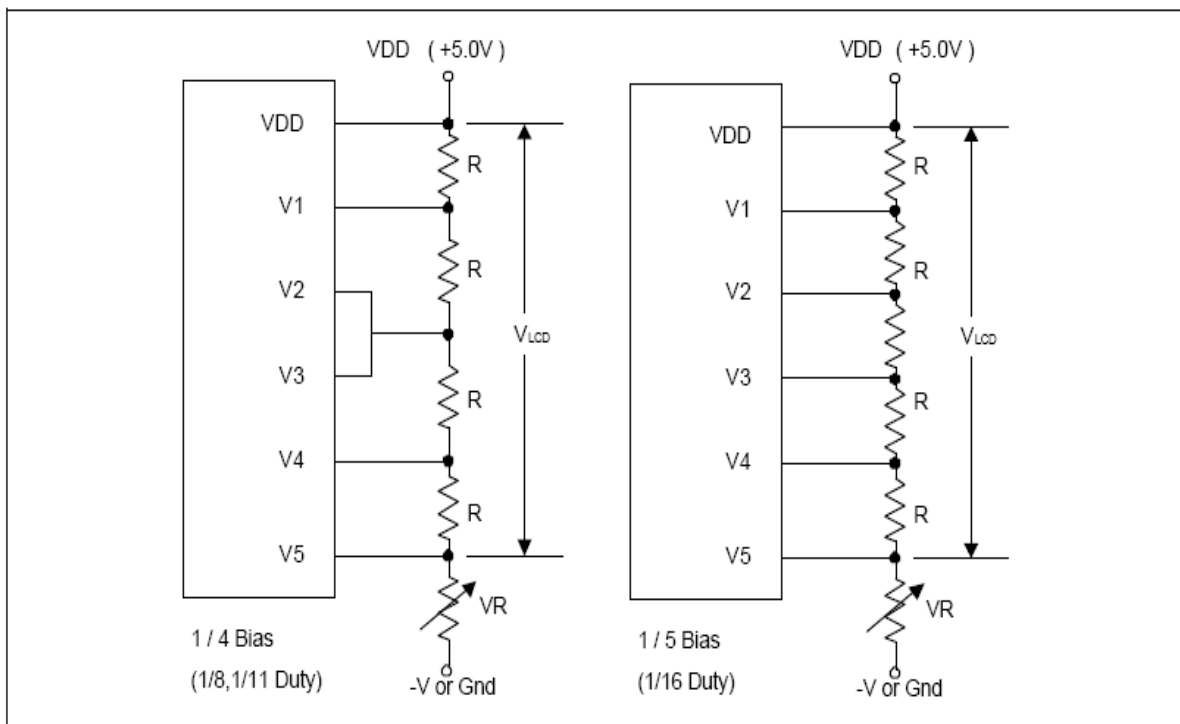
The bypass-capacitor improves the LCD display quality.
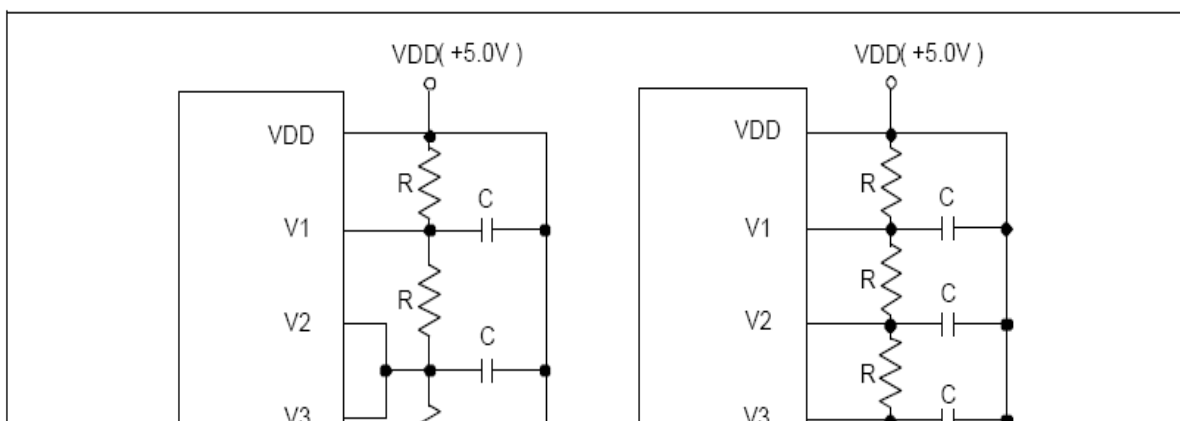
3.1   Inspection Specification

◆Inspection Standard : MIL-STD-105E Table Normal Inspection Single Sampling Level Ⅱ .

◆Equipment : Gauge、MIL-STD、Powertip Tester、Sample

◆Defect Level : Major Defect AQL 0.4; Minor Defect AQL 1.5 .

◆OUT Going Defect Level : Sampling .

◆Manner of appearance test :

(1). The test be under 40W×2 fluorescent light ' and distance of view must be at 30 cm.

(2). The test direction is base on about around 45° of vertical line.   (Fig. 1)

(3). Definition of area . (Fig. 2)

B area : Outside of viewing area

A area : viewing area
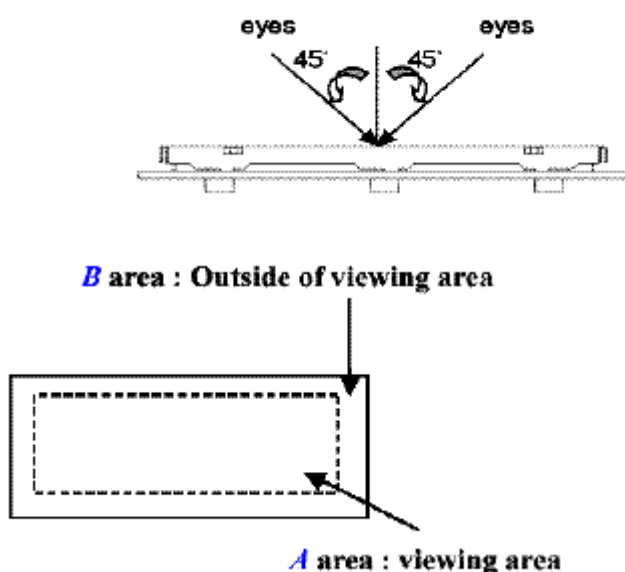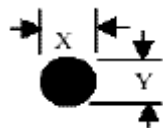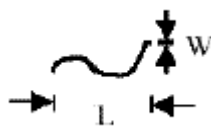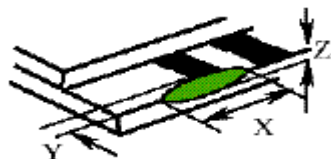
◆ Specification:

NO	Item	Criterion	level
01	Product condition	1.1 The part number is inconsistent with work order of Production.	Major
		1.2 Mixed production types.	Major
		1.3 Assembled in inverse direction.	Major
02	Quantity	2.1 The quantity is inconsistent with work order of production.	Major
03	Outline dimension	3.1 Product dimension and structure must conform to Structure diagram.	Major
04	Electrical Testing	4.1 Missing line character、dot and icon.	Major
		4.2 No function or no display.	Major
		4.3 Output data is error.	Major
		4.4 LCD viewing angle defect.	Major
		4.5 Current consumption exceeds product specifications.	Major
05	Black or white dot、scratch、contamination Round type	5.1 Round type: 5.1.1 display only : White and black spots on display ≦ 0.25mm, no more than Four white or black spots present. Densely spaced : NO more than two spots or lines within3mm	Minor
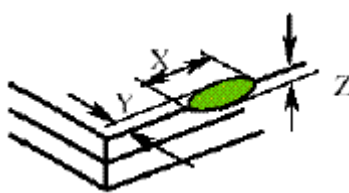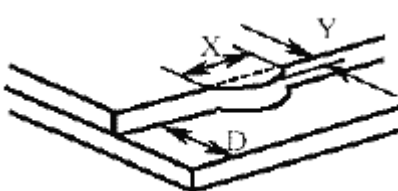
◆Specification :

NO	Item	Criterion			level
05	Black or white dot、scratch、contamination Round type $\Phi=(x+y)/2$	5.1.2 Nom-display : 5.1.3 Line type:			Minor

5.1.2 Nom-display :

Dimension (diameter : Φ)	Acceptance(Q'ty)
Φ≦0.10mm	Accept no dense
0.10mm＜Φ≦0.20mm	3
0.20mm＜Φ≦0.25mm	2
Total	4

5.1.3 Line type:

Dimension (diameter : Φ)		Acceptance (Q'ty)	
Length	width	A area	B area
---	w≦0.03mm	Accept no dense	Don't count
L≦3.0mm	0.03mm＜Φ≦0.05mm	4	Don't count
L≦2.5mm	0.05mm＜Φ≦0.075mm		Don't count
---	w＞0.075mm	As round type	

06	Polarizer Bubble	(see table below)	Minor

Dimension (diameter : Φ)	Acceptance(Q'ty)	
	A area	B area
Φ≦0.20mm	Accept no dense	Don't count
0.20mm＜Φ≦0.50mm	3	Don't count
0.50mm＜Φ≦1.00mm	2	Don't count
Φ＞1.00mm	0	Don't count
Total quantity	4	Don't count

07	The crack of glass	(see below)	Minor

● Glass Crack:
7.1 Crack on the circuit of electrode terminal :

	X	Y	Z
Front	X≦1/5 a	Y≦ 1/2 D	Z≦ t
Back	Neglect		
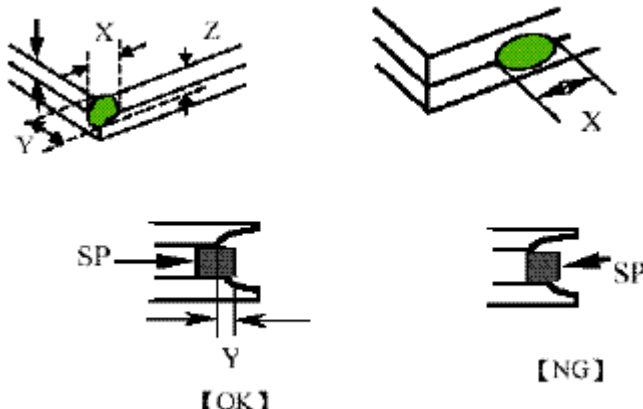
◆Specification :

NO	Item	Criterion	Level
07	The crack of glass X: The length of Crack Y: The width of crack Z: The thickness of crack D: terminal length T: The thickness of glass A : The length of glass	● Glass Crack: 7.2 General glass crack and corner edge: 7.2.1 7.2.2 7.3 Glass remain:	Minor Minor

7.2.1

X	Y	Z
Neglect	Out A area	Neglect

7.2.2

X	Y	Z
Neglect	Out A area	Neglect

7.3 Glass remain:

X	Y
Neglect	$\leqq$ 1/3 d

◆Specification :

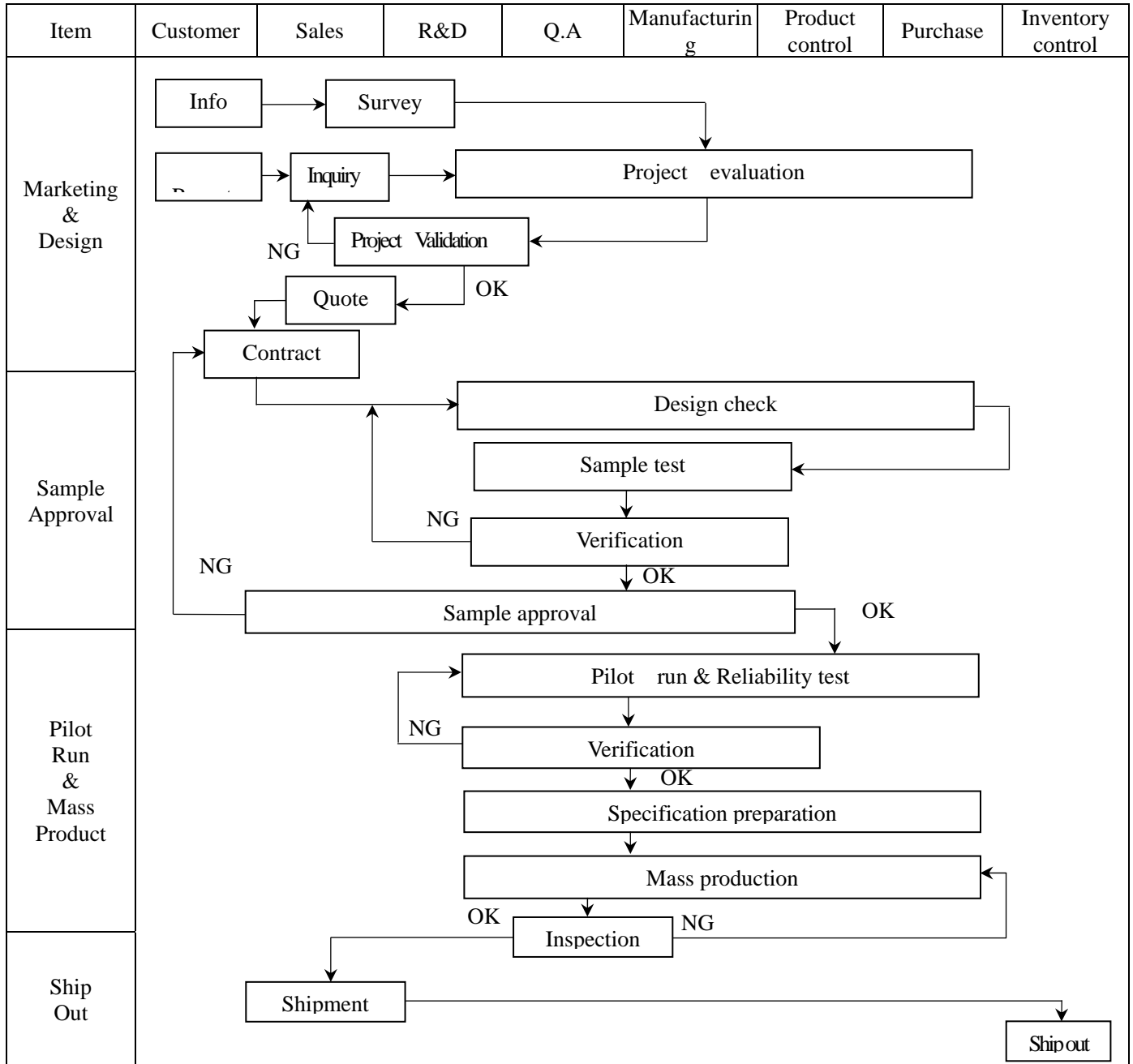| NO	Item	Criterion	Level
07	The crack of glass X: The length of Crack Y: The width of crack Z: The thickness of crack D: terminal length T: The thickness of glass A : The length of glass	7.4 Corner crack and medial crack: | X	Y	Z
---	---	---
$\leqq 1/5a$	Crack can't enter viewing area	$\leqq 1/2t$
$\leqq 1/5a$	Crack can't exceed the half of width of SP width of SP	$1/2t<Z \leqq 2t$		Minor
08	Backlight elements	8.1 Backlight can't work normally.	Major
		8.2 Backlight doesn't light or color is wrong.	Major
		8.3 Illumination source flickers when lit.	Major
09	General appearance	9.1 pin type must match type in specification sheet	Major
		9.2 No short circuits in components on PCB or FPC	Major
		9.3Product packaging must the same as specified on packaging specification sheet.	Major
		9.4 The folding and peeled off in polarizer are not acceptable	Major
		9.5 The PCB or FPC between B/L assembled distance (PCB or FPC) is $\leqq 1.5mm$	Major

4. RELIABILITY TEST
4.1 Reliability Test Condition

NO.	TEST ITEM	TEST CONDITION	
1	High Temperature Storage Test	Keep in 80 ±2℃ 96 hrs Surrounding temperature, then storage at normal condition 4hrs	
2	Low Temperature Storage Test	Keep in -30 ±2℃ 96 hrs Surrounding temperature, then storage at normal condition 4hrs	
3	High Humidity Storage	Keep in +60℃/90%RH duration for 96 hrs Surrounding temperature, then storage at normal condition 4hrs (Excluding the polarizer)Or Keep in +40℃/90%RH duration for 96 hrs Surrounding temperature, then storage at normal condition 4hrs	
4	Vibration Test	1. Sine wave 10～55HZ frequency (1 min) 2. The amplitude of vibration :1.5 mm 3. Each direction (XYZ) duration for 2 Hrs	
5	ESD Test	Air Discharge: Apply 6 KV with 5 times Discharge foreach polarity +/-	Contact Discharge: Apply 250V with 5 times discharge foreach polarity +/-
		1. Temperature ambinace:15℃～35℃ 2. Humidity relative:30%～60% 3. Energy Storage Capacitance(Cs+Cd):150pF±10% 4. Discharge Resistance(Rd):330Ω±10% 5. Discharge, mode of operation: Single Discharge (time between successive discharges at least 1 s) (Tolerance lf the output voltage indication: ±5%)	
6	Temperature Cycling Test	-20℃ → 25℃ → 70℃ → 25℃ (30mins) (5mins) (30mins) (5mins) 10 Cycle ←————————————→ Surrounding temperature, then storage at normal condition 4hrs	
7	Vibration Test (Packaged)	1. Sine wave 10～55HZ frequency (1 min) 2. The amplitude of vibration :1.5 mm 3. Each direction (XYZ) duration for 2 Hrs	
8	Drop Test (Packaged)	<table><tr><td>Packing Weight (Kg)</td><td>Drop Height (cm)</td></tr><tr><td>0 ~ 45.4</td><td>122</td></tr><tr><td>45.4 ~ 90.8</td><td>76</td></tr><tr><td>90.8 ~ 454</td><td>61</td></tr><tr><td>Over 454</td><td>46</td></tr></table> Drop direction :※3 comer /1 edges /6 sides etch 1times	

4.2QUALITY ASSURANCE SYSTEM

Item	Customer	Sales	R&D	Q.A	Manufacturing	Product control	Purchase	Inventory control
Marketing & Design								
Sample Approval								
Pilot Run & Mass Product								
Ship Out								

Info → Survey

Inquiry → Project   evaluation

Project Validation   NG

Quote   OK

Contract

Design check

Sample test

Verification   NG   OK

Sample approval   OK   NG

Pilot   run & Reliability test

Verification   NG   OK

Specification preparation

Mass production

Inspection   OK   NG

Shipment

Ship out

Quality Assurance Flow Chart

Item	Customer	Sales	R&D	Q.A	Manufacturing	Product control	Purchase	Inventory control
Sales Service								
Q.A Activity	1. ISO 9001 Maintenance Activities 2. Process improvement proposal 3. Equipment calibration 4. Education And Training Activities 5. Standardization Management							

Flow chart (Sales Service row):

Info → Claim → Failure analysis

Failure analysis → Analysis report

Failure analysis → Corrective action → Tracking

5. PRECAUTION RELATING PRODUCT HANDLING

5.1 SAFETY

5.1.1   If the LCD panel breaks , be careful not to get the liquid crystal to touch your skin.

5.1.2   If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.

5.2 HANDLING

5.2.1   Avoid any strong mechanical shock which can break the glass.

5.2.2   Avoid static electricity which can damage the CMOS LSI—When working with the module , be sure to ground your body and any electrical equipment you may be using.

5.2.3   Do not remove the panel or frame from the module.

5.2.4   The polarizing plate of the display is very fragile. So , please handle it very carefully, do not touch , push or rub the exposed polarizing with anything harder than an HB pencil lead (glass , tweezers , etc.)

5.2.5   Do not wipe the polarizing plate with a dry cloth , as it may easily scratch the surface of plate.

5.2.6   Do not touch the display area with bare hands , this will stain the display area.

5.2.7   Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.

5.2.8   To control temperature and time of soldering is 280 ± 10°C and 3-5 sec.

5.2.9   To avoid liquid (include organic solvent) stained on LCM

5.3 STORAGE

5.3.1   Store the panel or module in a dark place where the temperature is 25°C ± 5°C and the humidity is below 65% RH.

5.3.2   Do not place the module near organics solvents or corrosive gases.

5.3.3   Do not crush , shake , or jolt the module.

5.4 TERMS OF WARRANTY

5.4.1   Applicable warrant period
          The period is within thirteen months since the date of shipping out under normal using and storage conditions.

5.4.2   Unaccepted responsibility
          This product has been manufactured to your company's specification as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in nuclear power control equipment, aerospace equipment , fire and security systems or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required.