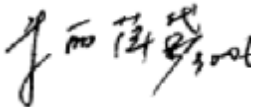
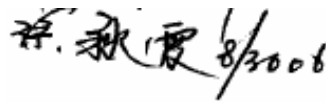


SPECIFICATIONS

CUSTOMER : _____
SAMPLE CODE (Ver.) : _____
MASS PRODUCTION CODE (Ver.) RC1602ARU-ESO-A (Ver.0)
DRAWING NO. (Ver.) PC-95034

Customer Approved

Date:

Approved	QC Confirmed	Designer
		

☒ Approval For Specifications Only.

* This specification is subject to change without notice.

Please contact Powertip or it's representative before designing your product based on this specification.

☐ Approval For Specifications and Sample.

RECORDS OF REVISION

Date	Rev.	Description	Note	Page
2006/8/30	0	PC1602ARU-ESO-A-Q is the ROHS compliant part number based on Powertip's standard PC1602ARU-ESO-A		

Total : 22Page

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- 1.2 Mechanical Specifications**
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- 2.2 Interface Pin Description**
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5. PRECAUTION RELATING PRODUCT HANDLING

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- 5.2 Handling**
- 5.3 Storage**
- 5.4 Terms of Warranty**

6. PACKING Specification

Note : For detailed information please refer to IC data sheet : **KS0066U,KS0065B**

1. SPECIFICATIONS

1.1 Features

Item	Standard Value
Display Type	16*2 Characters
LCD Type	STN YG Positive Reflective Normal Temp.
Driver Condition	LCD Module : 1/16 Duty , 1/4 Bias
Viewing Direction	6 O'clock
Backlight	—
Weight	13 g
Interface	—
ROHS	THIS PRODUCT CONFORMS THE ROHS OF PTC Detail information please refer web side : http://www.powertip.com.tw/news/LatestNews.asp

1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	66.7(L)*23.3(W)*4.2(H)(max)	mm
Viewing Area	61.0(L)*15.9(W)	mm
Active Area	56.2(L)*11.85(W)	mm
Dot Size	0.55(L)*0.65(W)	mm
Dot Pitch	0.60(L)*0.70(W)	mm

Note : For detailed information please refer to LCM drawing

1.3 Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit
Power Supply Voltage	V _{DD}	—	-0.3	7.0	V
LCD Driver Supply Voltage	V _{LCD}	—	V _{DD} -15.0	V _{DD} +0.3	V
Input Voltage	V _{IN}	—	-0.3	V _{DD} +0.3	V
Operating Temperature	T _{OP}	Excluded B/L	0	50	°C
Storage Temperature	T _{ST}	Excluded B/L	-20	70	°C
Storage Humidity	H _D	Ta < 40 °C	-	90	%RH

1.4 DC Electrical Characteristics

$V_{DD} = 5.0 \text{ V} \pm 0.5 \text{ V}$, $V_{SS} = 0 \text{ V}$, $T_a = 25^\circ\text{C}$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage	V_{DD}	—	4.5	5.0	5.5	V
“H” Input Voltage	V_{IH}	—	2.2	-	V_{DD}	V
“L” Input Voltage	V_{IL}	—	-0.3	-	0.6	V
“H” Output Voltage	V_{OH}	$I_{OH} = -0.205 \text{ mA}$	2.4	-	-	V
“L” Output Voltage	V_{OL}	$I_{OL} = 1.2 \text{ mA}$	-	-	0.4	V
Supply Current	I_{DD}	$V_{DD} = 5.0 \text{ V}$	-	2.0	3.0	mA
LCM Driver Voltage	V_{OP}	0°C	-	-	-	V
		$25^\circ\text{C} *1$	4.0	4.2	4.4	
		50°C	-	-	-	

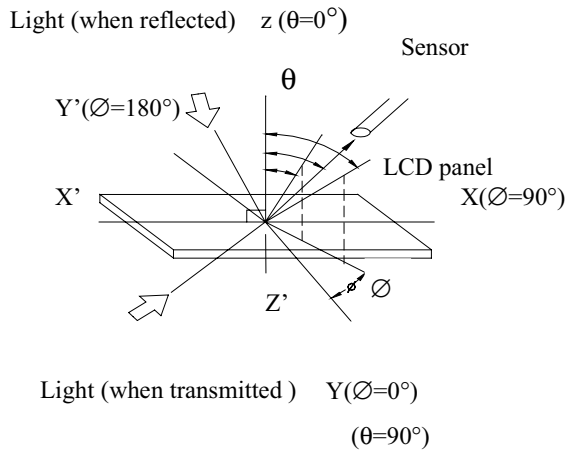
Note: *1. THE V_{OP} TEST POINT IS $V_{DD} - V_O$.

1.5 Optical Characteristics

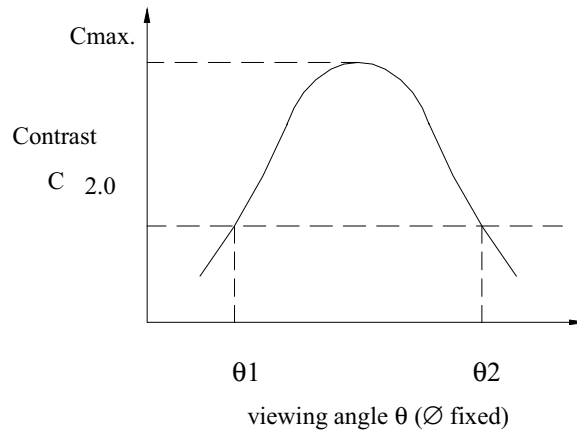
LCD Panel : 1/16 Duty , 1/4 Bias , $V_{LCD} = 4.22 \text{ V}$, $T_a = 25^\circ\text{C}$

Item	Symbol	Conditions	Min.	Typ.	Max.	Reference
View Angle	θ	$C \geq 2.0, \varnothing = 0^\circ$	0°	-	45°	Notes 1 & 2
Contrast Ratio	C	$\theta = 5^\circ, \varnothing = 0^\circ$	-	7	-	Note 3
Response Time(rise)	t_r	$\theta = 5^\circ, \varnothing = 0^\circ$	-	148 ms	-	Note 4
Response Time(fall)	t_f	$\theta = 5^\circ, \varnothing = 0^\circ$	-	302 ms	-	Note 4

Note 1: Definition of angles θ and ϕ



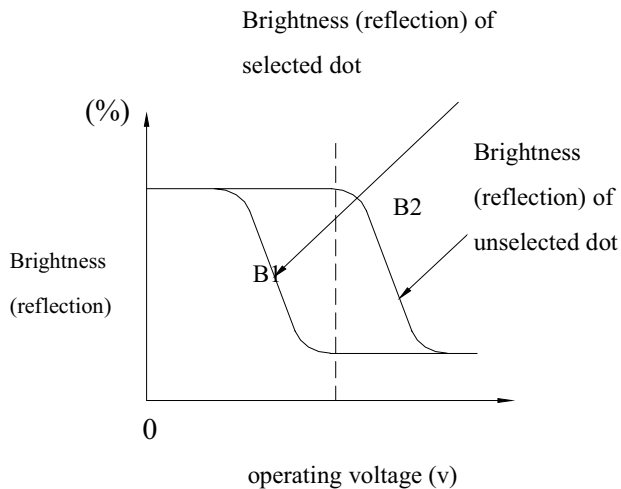
Note 2: Definition of viewing angles θ_1 and θ_2



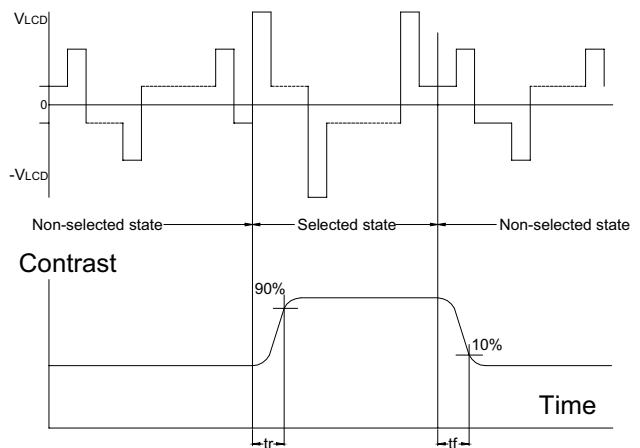
Note : Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same

Note 3: Definition of contrast C

$$C = \frac{\text{Brightness (reflection) of unselected dot (B2)}}{\text{Brightness (reflection) of selected dot (B1)}}$$



Note 4: Definition of response time



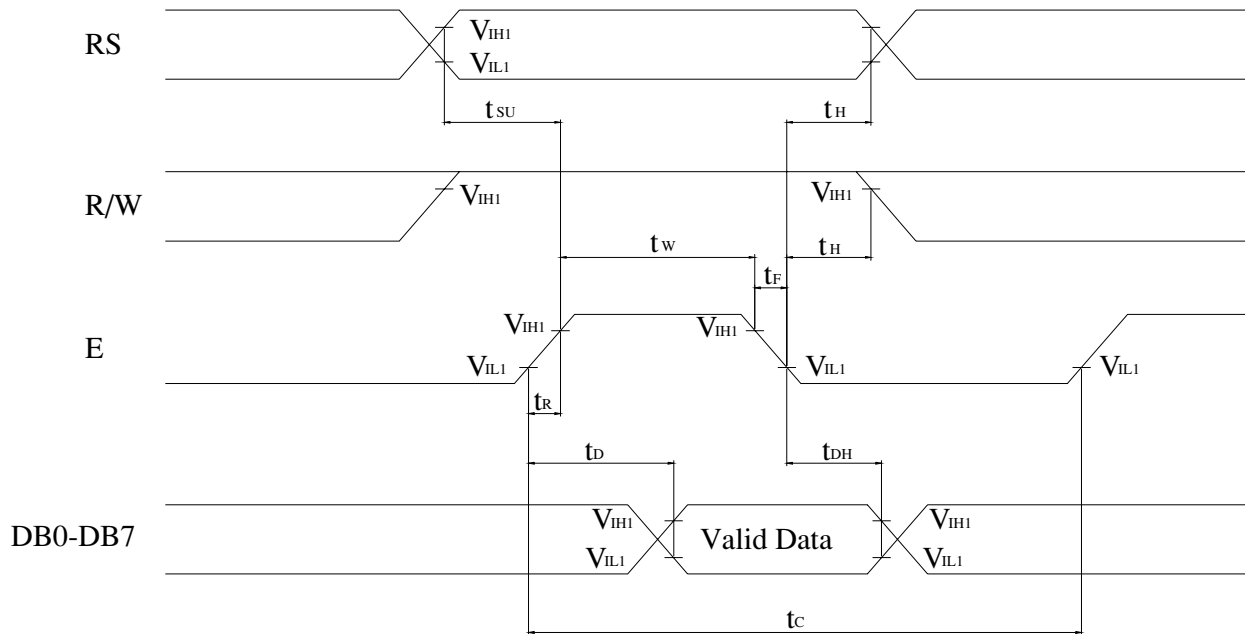
Note: Measured with a transmissive LCD panel which is displayed 1 cm^2

V_{LCD} : Operating voltage f_{FRM} : Frame frequency

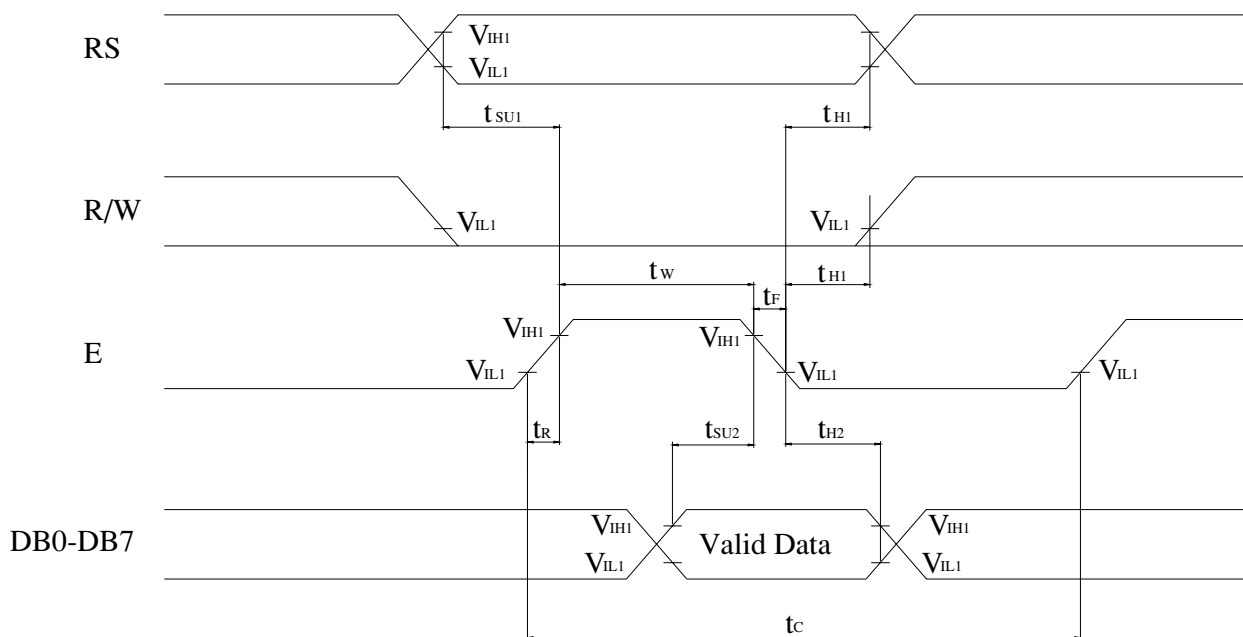
t_r : Response time (rise) t_f : Response time (fall)

2.3 Timing Characteristics

• Read cycle



• Write cycle



• Read cycle

VDD=4.5V~5.5V, Ta=25°C

Characteristics	Symbol	Min.	Typ.	Max.	Unit
E Cycle Time	t_C	500	-	-	ns
E Rise / Fall Time	t_R, t_F	-	-	20	ns
E Pulse Width (High, Low)	t_W	230	-	-	ns
R/W and RS Setup Time	t_{SU}	40	-	-	ns
R/W and RS Hold Time	t_H	10	-	-	ns
Data Output Delay Time	t_D	-	-	120	ns
Data Hold Time	t_{DH}	5	-	-	ns

• Write cycle

Characteristics	Symbol	Min.	Typ.	Max.	Unit
E Cycle Time	t_C	500	-	-	ns
E Rise / Fall Time	t_R, t_F	-	-	20	ns
E Pulse Width (High, Low)	t_W	230	-	-	ns
R/W and RS Setup Time	t_{SU1}	40	-	-	ns
R/W and RS Hold Time	t_{H1}	10	-	-	ns
Data Setup Time	t_{SU2}	80	-	-	ns
Data Hold Time	t_{H2}	10	-	-	ns

2.4 Display Command

Instructions	Instruction Code										Description	Description Time (270KHz)
	RS	R/W	DB 7	DB 6	DB 5	DB 4	DB 3	DB 2	DB 1	DB 0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC.	1.52ms
Return Home	0	0	0	0	0	0	0	0	1	×	Set DDRAM address to "00H" from AC and return cursor to it's original position if shifted. The contents of DDRAM are not changed.	1.52ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read .	37μs
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1 : entire display on C=1 : cursor on B=1 : cursor position on	37μs
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	×	×	Set cursor moving and display shift control bit, and the direction, without changing of DDRAM data.	37μs
Function Set	0	0	0	0	1	DL	N	F	×	×	DL: interface data is 8/4 bits NL: number of line is 2/1 F: font size is 5×11/5×8	37μs
Set CGRAM Address	0	0	0	1	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0	Set CGRAM address in address counter.	37μs
Set DDRAM Address	0	0	1	AC 6	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0	Set DDRAM address in address counter.	37μs

Read Busy Flag and Address	0	1	BF	AC 6	AC 5	AC 4	AC 3	AC 2	AC 1	AC 0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0 μ s
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	37 μ s
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	37 μ s

Note:

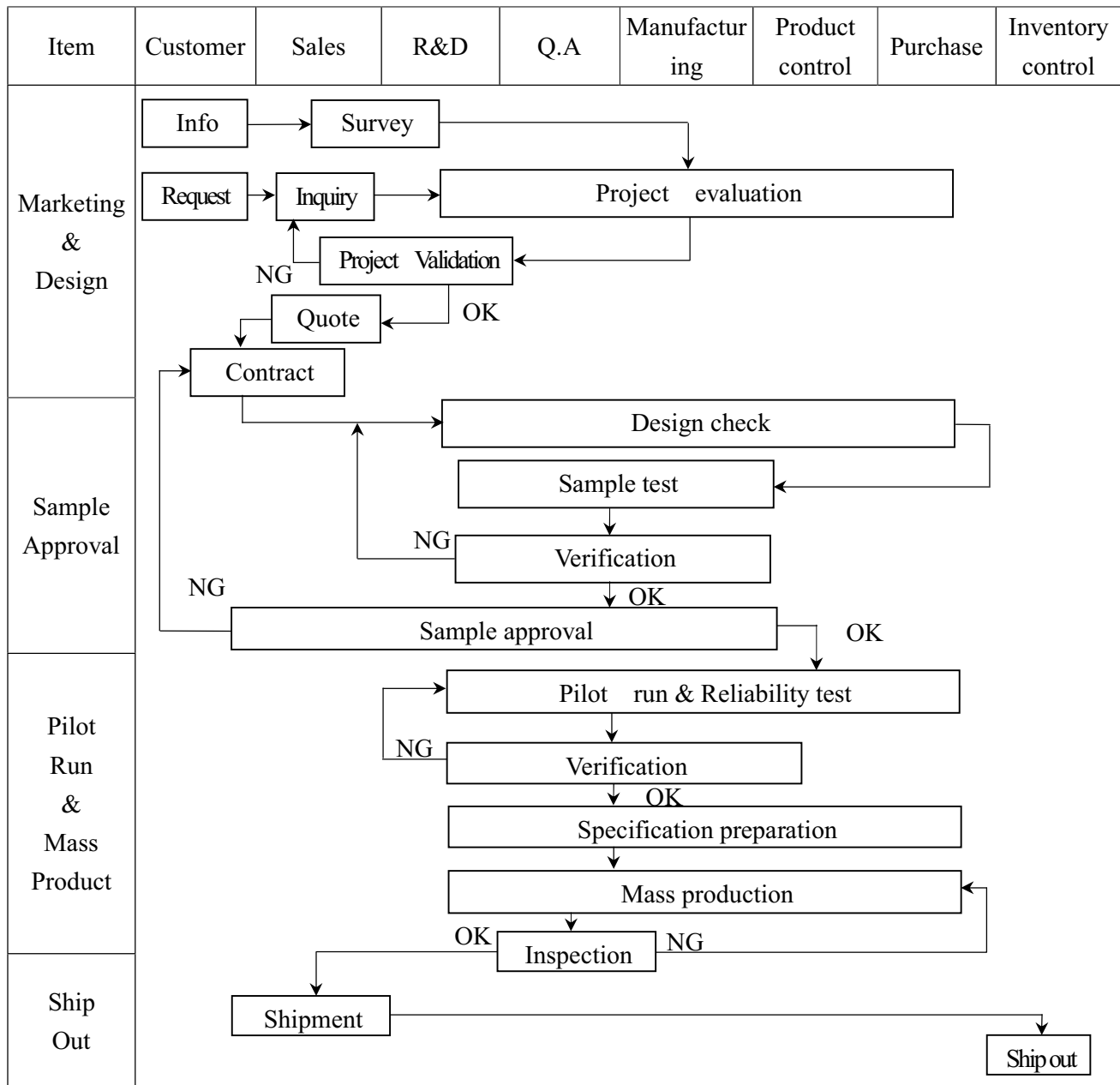
Be sure the ST7066U is not in the busy state (BF=0) before sending an instruction from the MPU to the ST7066.

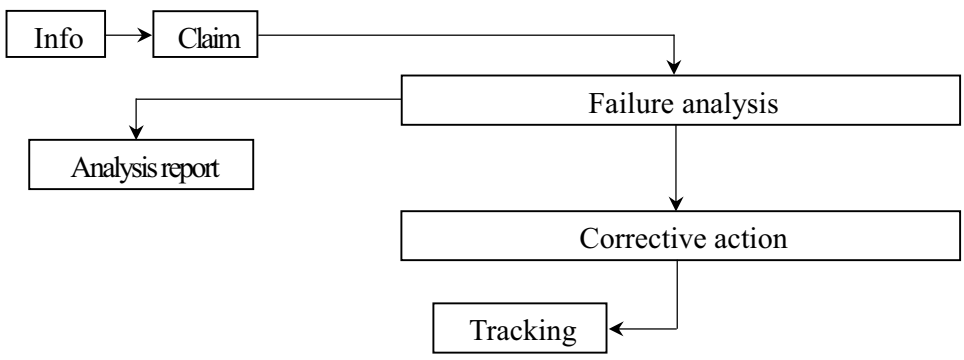
If an instruction is sent without checking the busy flag , the time between the first instruction and next instruction will take much longer than the instruction time itself.

Refer to Instruction Table for the list of each instruction execution time .

3. QUALITY ASSURANCE SYSTEM

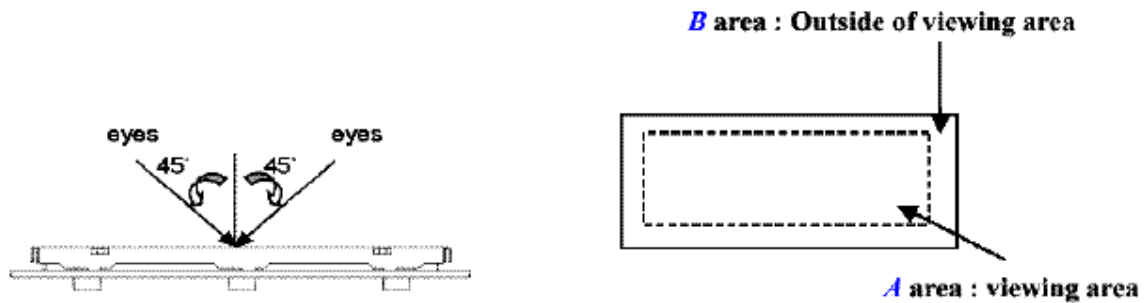
3.1 Quality Assurance Flow Chart



Item	Customer	Sales	R&D	Q.A	Manufacturing	Product control	Purchase	Inventory control
Sales Service	 <pre> graph TD Info[Info] --> Claim[Claim] Claim --> Failure[Failure analysis] Claim --> Report[Analysis report] Failure --> Action[Corrective action] Action --> Tracking[Tracking] </pre>							
Q.A Activity	<div>1. ISO 9001 Maintenance Activities</div> <div>3. Equipment calibration</div> <div>5. Standardization Management</div> <div>2. Process improvement proposal</div> <div>4. Education And Training Activities</div>							

3.2 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)

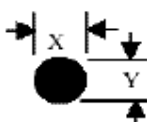
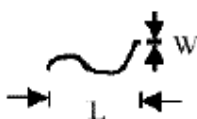
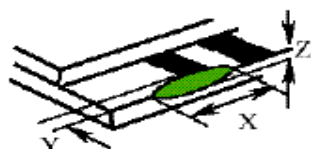


◆ Specification:

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 : <ul style="list-style-type: none"> • White and black spots on display $\leq 0.25\text{mm}$, no more than Four white or black spots present. • Densely spaced : NO more than two spots or lines within 3mm 	Minor

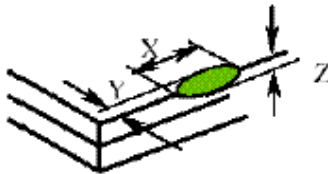

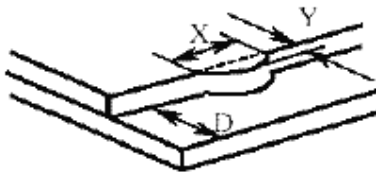


◆Specification :

NO	Item	Criterion	level																																											
05	<p>Black or white dot、scratch、contamination</p> <p>Round type</p>  <p>$\Phi=(x+y)/2$</p> 	<p>5.1.2 Nom-display :</p> <table><tr><th colspan="2">Dimension (diameter : Φ)</th><th colspan="2">Acceptance(Q'ty)</th></tr><tr><td colspan="2">Φ ≤ 0.10mm</td><td colspan="2">Accept no dense</td></tr><tr><td colspan="2">0.10mm < Φ ≤ 0.20mm</td><td colspan="2">3</td></tr><tr><td colspan="2">0.20mm < Φ ≤ 0.25mm</td><td colspan="2">2</td></tr><tr><td colspan="2">Total</td><td colspan="2">4</td></tr></table> <p>5.1.3 Line type:</p> <table><tr><th colspan="2">Dimension (diameter : Φ)</th><th colspan="2">Acceptance (Q'ty)</th></tr><tr><th>Length</th><th>width</th><th>A area</th><th>B area</th></tr><tr><td>---</td><td>w ≤ 0.03mm</td><td>Accept no dense</td><td>Don't count</td></tr><tr><td>L ≤ 3.0mm</td><td>0.03mm < Φ ≤ 0.05mm</td><td rowspan="2">4</td><td>Don't count</td></tr><tr><td>L ≤ 2.5mm</td><td>0.05mm < Φ ≤ 0.075mm</td><td>Don't count</td></tr><tr><td>---</td><td>w > 0.075mm</td><td colspan="2">As round type</td></tr></table>	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		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		Minor
Dimension (diameter : Φ)		Acceptance(Q'ty)																																												
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---	w > 0.075mm	As round type																																												
06	<p>Polarizer</p> <p>Bubble</p>	<table><tr><th rowspan="2">Dimension (diameter : Φ)</th><th colspan="2">Acceptance(Q'ty)</th></tr><tr><th>A area</th><th>B area</th></tr><tr><td>Φ ≤ 0.20mm</td><td>Accept no dense</td><td>Don't count</td></tr><tr><td>0.20mm < Φ ≤ 0.50mm</td><td>3</td><td>Don't count</td></tr><tr><td>0.50mm < Φ ≤ 1.00mm</td><td>2</td><td>Don't count</td></tr><tr><td>Φ > 1.00mm</td><td>0</td><td>Don't count</td></tr><tr><td>Total quantity</td><td>4</td><td>Don't count</td></tr></table>	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	Minor																							
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Total quantity	4	Don't count																																												
07	<p>The crack of glass</p>	<p>● Glass Crack:</p> <p>7.1 Crack on the circuit of electrode terminal :</p>  <table><tr><th></th><th>X</th><th>Y</th><th>Z</th></tr><tr><td>Front</td><td>X ≤ 1/5 a</td><td>Y ≤ 1/2 D</td><td>Z ≤ t</td></tr><tr><td>Back</td><td colspan="3">Neglect</td></tr></table>		X	Y	Z	Front	X ≤ 1/5 a	Y ≤ 1/2 D	Z ≤ t	Back	Neglect			Minor																															
	X	Y	Z																																											
Front	X ≤ 1/5 a	Y ≤ 1/2 D	Z ≤ t																																											
Back	Neglect																																													

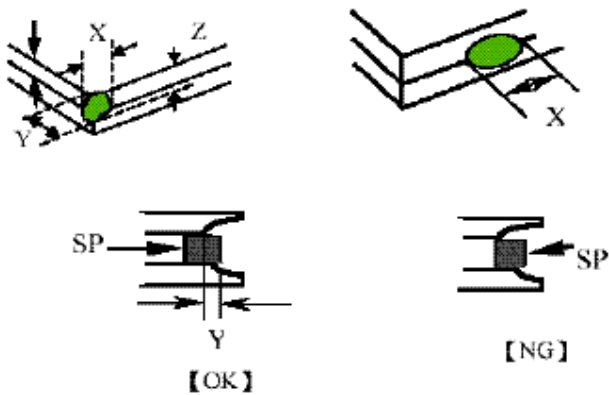


◆Specification :

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	<p>● Glass Crack:</p> <p>7.2 General glass crack and corner edge:</p> <p>7.2.1</p>  <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>Neglect</td><td>Out A area</td><td>Neglect</td></tr></table> <p>7.2.2</p>  <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>Neglect</td><td>Out A area</td><td>Neglect</td></tr></table>	X	Y	Z	Neglect	Out A area	Neglect	X	Y	Z	Neglect	Out A area	Neglect	Minor
		X	Y	Z											
Neglect	Out A area	Neglect													
X	Y	Z													
Neglect	Out A area	Neglect													
		<p>7.3 Glass remain:</p>  <table><tr><td>X</td><td>Y</td></tr><tr><td>Neglect</td><td>$\leq 1/3 d$</td></tr></table>	X	Y	Neglect	$\leq 1/3 d$	Minor								
X	Y														
Neglect	$\leq 1/3 d$														



◆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: 	Minor									
		<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>$\leq 1/5a$</td><td>Crack can't enter viewing area</td><td>$\leq 1/2t$</td></tr><tr><td>$\leq 1/5a$</td><td>Crack can't exceed the half of width of SP</td><td>$1/2t < Z \leq 2t$</td></tr></table>		X	Y	Z	$\leq 1/5a$	Crack can't enter viewing area	$\leq 1/2t$	$\leq 1/5a$	Crack can't exceed the half of width of SP	$1/2t < Z \leq 2t$
		X		Y	Z							
		$\leq 1/5a$		Crack can't enter viewing area	$\leq 1/2t$							
		$\leq 1/5a$		Crack can't exceed the half of width of SP	$1/2t < Z \leq 2t$							
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 $\leq 1.5\text{mm}$	Major									

4. RELIABILITY TEST

4.1 Reliability Test Condition

NO.	TEST ITEM	TEST CONDITION	
1	High Temperature Storage Test	Keep in 70 ±2℃ 96 hrs Surrounding temperature, then storage at normal condition 4hrs	
2	Low Temperature Storage Test	Keep in -20 ±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 If the output voltage indication: ±5%)	
6	Temperature Cycling Test	<div><div>-20℃ → 25℃ → 70℃ → 25℃</div><div><div>(30mins) (5mins) (30mins) (5mins)</div><div>↔</div></div><div>10 Cycle</div></div> 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)		
		Packing Weight (Kg)	Drop Height (cm)
		0 ～ 45.4	122
		45.4 ～ 90.8	76
		90.8 ～ 454	61
Over 454	46		
Drop direction :※3 comer /1 edges /6 sides etch 1times			

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 $320\pm 10^{\circ}\text{C}$ 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 $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ 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.