SPECIFICATIONS

CUSTOMER :

SAMPLE CODE :

(This Code will be changed while mass production)

MASS PRODUCTION CODE : **PC1602LRS-LNH-H (VER.0)**

Customer Approved

Date:

Sales Sign	QC Confirmed	Checked By	Designer
		Nancy's 2003/06/21 *Tom* 2003/06/21	宋玉森 2003/06/21

☐ 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
2003/06/21	0	Revised Contents		

Total：20 Page

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   Note：For detailed information please refer to IC data sheet：**NT3881D,KS0065B**

1. SPECIFICATIONS

1.1 Features

Item	Standard Value
Display Type	16*2 Characters
LCD Type	STN Gray Positive Transflective Extended Temp.
Driver Condition	LCD Module：1/16 Duty，1/4 Bias
Viewing Direction	6 O' clock
Backlight	YG LED B/L
Weight	68 g
Interface	－
Other	－

1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	122.0(L) * 44.0(w) * 14.0(H)(Max)	mm
Viewing Area	99.0(L) * 24.0(w)	mm
Active Area	94.84(L) * 20.0(w)	mm
Dot Size	0.92(L) * 1.10(w)	mm
Dot Pitch	0.98(L) * 1.16(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}-13.5	V_{DD}+0.3	V
Input Voltage	V_{IN}	－	-0.3	V_{DD}+0.3	V
Operating Temperature	T_{OP}	Excluded B/L	-20	70	℃
Storage Temperature	T_{ST}	Excluded B/L	-30	80	℃
Storage Humidity	H_D	Ta＜40 ℃	-	90	%RH

1.4 DC Electrical Characteristics

$V_{DD} = 5.0\ V \pm 10\%$ ，$V_{SS} = 0V$ ，$Ta = 25^{\circ}C$

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	-	0.8	V
"H" Output Voltage	V_{OH}	I_{OH}=-0.25mA	2.4	-	-	V
"L" Output Voltage	V_{OL}	I_{OL}=1.2mA	-	-	0.4	V
Supply Current	I_{DD}	$V_{DD} = 5.0\ V$	-	1.5	-	mA
LCM Driver Voltage	V_{OP}	$V_{DD} - V_O\ (-20^{\circ}C)$	-	-	-	V
		$V_{DD} - V_O\ (25^{\circ}C)$	-	5.8	-	
		$V_{DD} - V_O\ (70^{\circ}C)$	-	-	-	

1.5 Optical Characteristics

LCD Panel：1/16 Duty ，1/4 Bias ，$V_{LCD} = 6.4\ V$ ，$Ta = 25^{\circ}C$

Item	Symbol	Conditions	Min.	Typ.	Max.	Reference
View Angle	è	$C \geq 2.0, \varnothing = 0°$	40°	-	-	Notes 1 & 2
Contrast Ratio	C	$è = 5°, \varnothing = 0°$	5	7	-	Note 3
Response Time(rise)	tr	$è = 5°, \varnothing = 0°$	-	150 ms	-	Note 4
Response Time(fall)	tf	$è = 5°, \varnothing = 0°$	-	330 ms	-	Note 4

![POWERTIP logo]

Note 1: Definition of angles θ and ∅

Light (when reflected)   z (θ=0°)

Sensor

Y' (∅=180°)

θ

LCD panel

X'

X(∅=90°)

Z'

∅
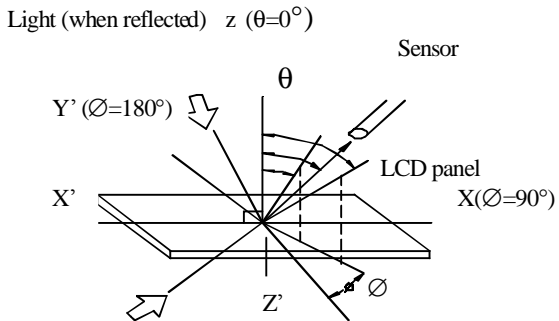
Light (when transmitted)   Y(∅=0°)

(θ=90°)

Note 2: Definition of viewing angles θ1 and θ2

Cmax.

Contrast

C   2.0

θ1   θ2
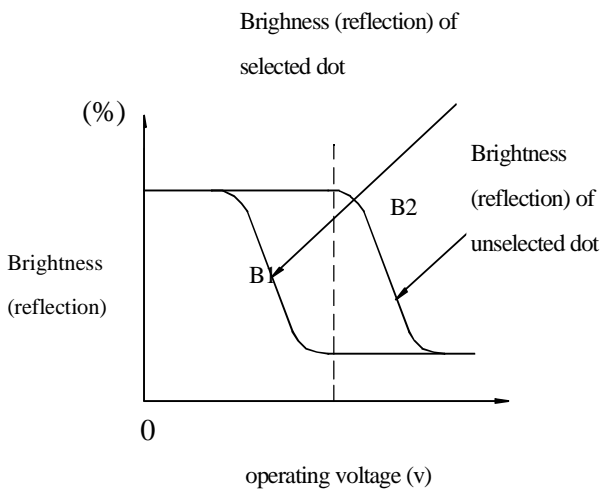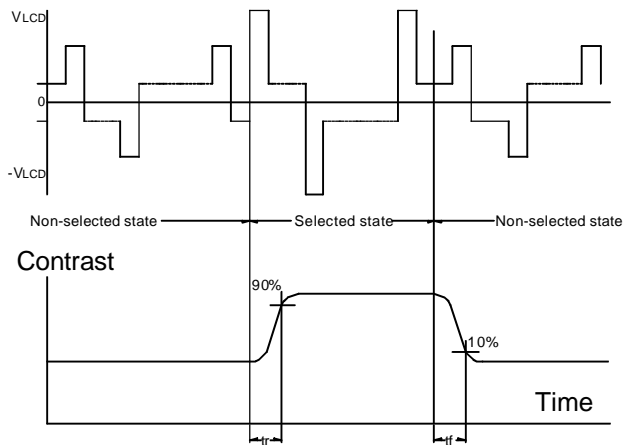
viewing angle θ (∅ fixed)
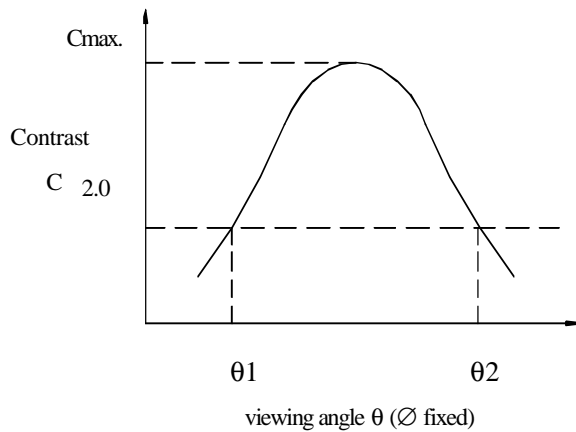
Note :   Optimum viewing angle with the

naked eye and viewing angle θ at

Cmax. Above are not always the same

Note 3: Definition of contrast C

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

Brighness (reflection) of

selected dot

(%)

Brightness

(reflection) of

unselected dot

B2

Brightness

(reflection)

B

0

operating voltage (v)

Note 4: Definition of response time

V_{LCD}

0

$-V_{LCD}$

Non-selected state   Selected state   Non-selected state

Contrast

90%

10%

Time

t_r t_f

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)

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1.6 Backlight Characteristics

LCD Module with LED Backlight

Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Forward Current	IF	Ta =25℃	-	480	mA
Reverse Voltage	VR	Ta =25℃	-	-8	V
Power Dissipation	PO	Ta =25℃	-	2.2	W
Operating Temperature	T_{OP}	-	-20	70	℃
Storage Temperature	T_{ST}	-	-40	80	℃
Solder Temp. for 3 Second	-	-	-	260	℃

Electrical / Optical Characteristics

Ta =25℃

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Forward Voltage	VF	IF=240 mA	4.0	4.2	4.6	V
Reverse Current	IR	VR=-8V	-	-	0.2	mA
Average Brightness (with LCD)	IV	IF=240 mA	-	-	-	cd/m^2
Wavelength	λ p	IF=240 mA	-	570	572	nm
Luminous Intensity (without LCD)	IV	IF=240 mA	80	100		cd/m^2
Color	Yellow-green					

2. MODULE STRUCTURE

2.1 Counter Drawing
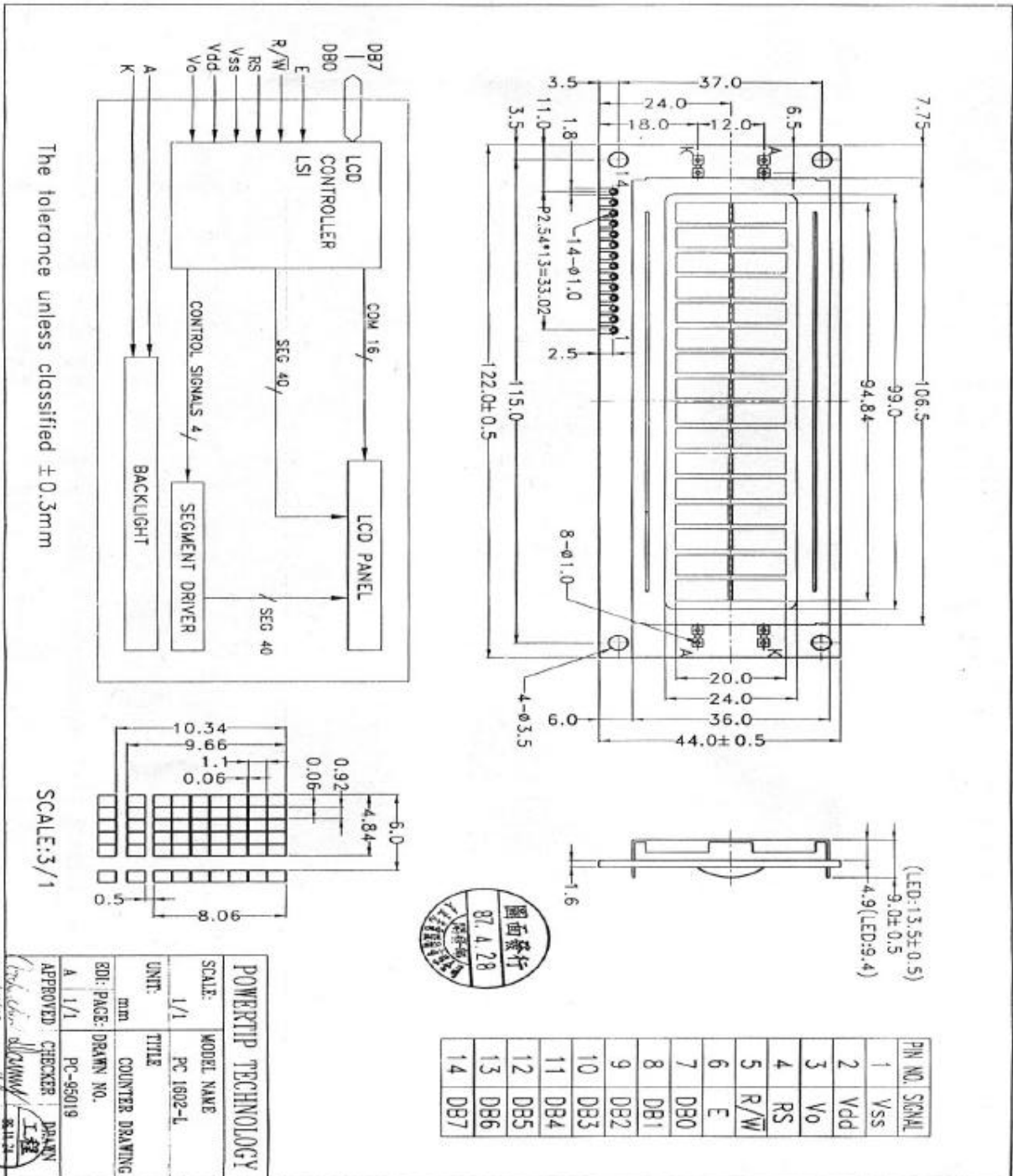
2.2 Interface Pin Description

Pin No.	Symbol	Function
1	Vss	Signal ground (GND)
2	VDD	Power Supply for logic (VDD > VSS)
3	VO	Operating Voltage for LCD (variable)
4	RS	Register Selection input High = Data register Low = Instruction register (for write) 　　Busy flag address counter (for read)
5	$\overline{R/W}$	R/W signal input is used to select the read/write mode High = Read mode,　Low = Write mode
6	E	Start enable signal to read or write the data
7~10	DB0 ~ DB3	Four low order bi-directional three-state data bus lines. Used For data transfer between the MPU and the LCD module. These four are not used during 4-bit operation.
11~14	DB4~DB7	Four high order bi-directional three-state data bus lines. Used for data transfer between the MPU and the LCD module. DB7 can be used as a busy flag.
	A	Power supply for LED B / L (+)
	K	Power supply for LED B / L (-)

Contrast Adjust
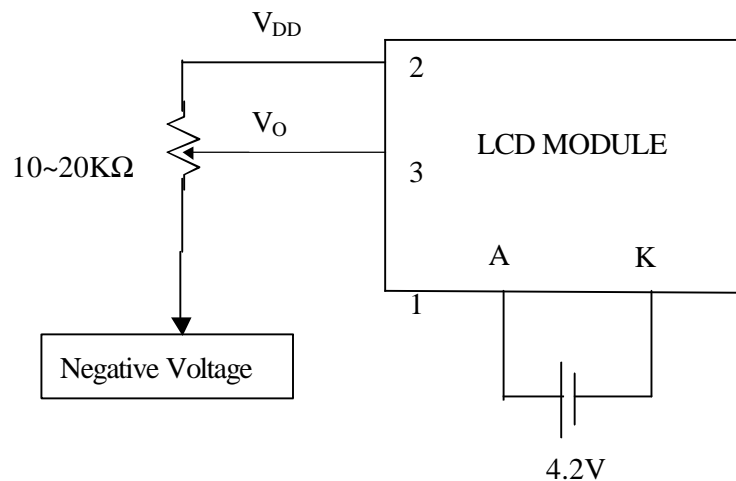
2.3 Timing Characteristics

- Read cycle

RS, R/W, E, DB0-DB7 timing diagram for read cycle with V_{IH1}, V_{IL1}, t_{SU}, t_H, t_W, t_F, t_R, t_D, t_{DH}, Valid Data, t_C

- Write cycle

RS, R/W, E, DB0-DB7 timing diagram for write cycle with V_{IH1}, V_{IL1}, t_{SU1}, t_{H1}, t_W, t_F, t_R, t_{SU2}, t_{H2}, Valid Data, t_C
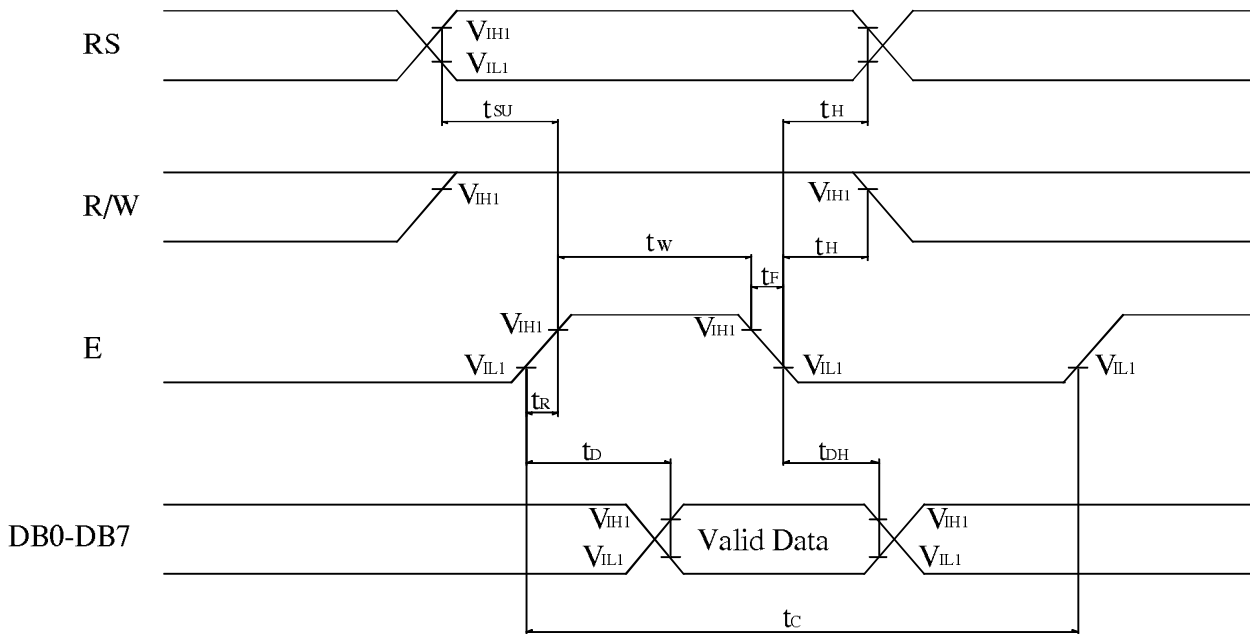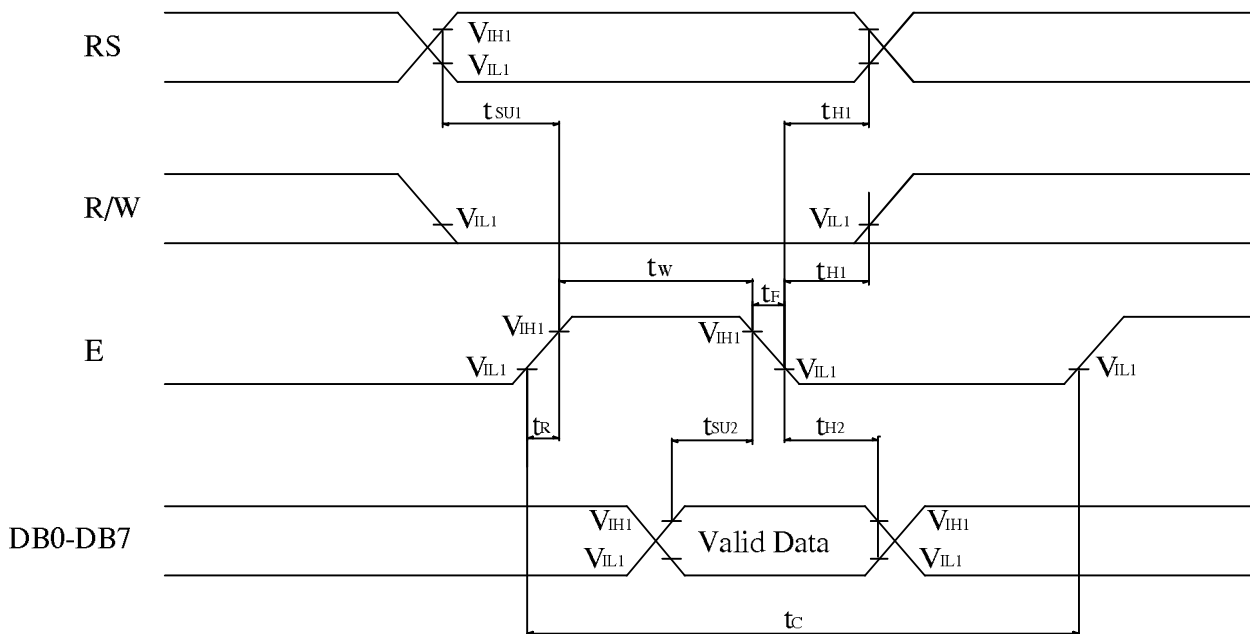
• Read cycle

$V_{DD}=5.0V\pm10\%, V_{SS}=0V, Ta=25°C$

Characteristics	Symbol	Condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cyCE}	-	500	-	-	ns
Enable "H" level pulse width	t_{WEH}	-	300	-	-	ns
Enable rise/fall time	t_{rE}, t_{fE}	-	-	-	25	ns
RS,R/W setup time	t_{AS}	-	60[1] 100[2]	-	-	ns
RS,R/W address hold time	t_{AH}	-	10	-	-	ns
Read data output delay	t_{RD}	$C_L=100pF$	-	-	190	ns
Read data hold time	t_{DHR}		20	-	-	ns

• Write cycle

Characteristics	Symbol	Condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cycE}	-	500	-	-	ns
Enable "H" level pulse width	t_{WEH}	-	300	-	-	ns
Enable rise/fall time	t_{rE}, t_{fE}	-	-	-	25	ns
RS,R/$\overline{W}$ setup time	t_{AS}	-	60[1] 100[2]	-	-	ns
RS,R/$\overline{W}$ address hold time	t_{AH}	-	10	-	-	ns
Data setup time	t_{DS}	-	100	-	-	ns
Write data hold time	t_{DH}	-	10	-	-	ns

Notes: 1: 8-bit operation mode

2: 4-bit operation mode

2.4 Display Command

Instructions	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	Execution Time(max) (f$_{osc}$= 250KHZ)
						Instruction Code						
Clear Display	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	1	×	Restore display from shift and load address counter with DD RAM address00H	1.64ms
Entry Mode Set	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)	40µs
Display ON/OFF Control	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).	40µs
Display/ Cursor Shift	0	0	0	0	0	1	S/C	R/L	×	×	Shift display or move cursor.	40µs
Function Set	0	0	0	0	1	DL	N	F	×	×	Set interface data length (D), number of display line (N), and character font (F).	40µs
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.	40µs
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.	40µs
Busy Flag/Address Counter Read	0	1	AC								Read Busy Flag (BF) and contents of Address Counter (AC).	40µs

CG RAM/DD RAM Data Write	1	0	Write data	Write data to CG RAM or DD RAM.	40μs
CG RAM/DD RAM Data Read	1	1	Read data	Read data from CG RAM or DD RAM	40μs

Note 1: Symbol "*" signifies an insignifcant bit (disregards).

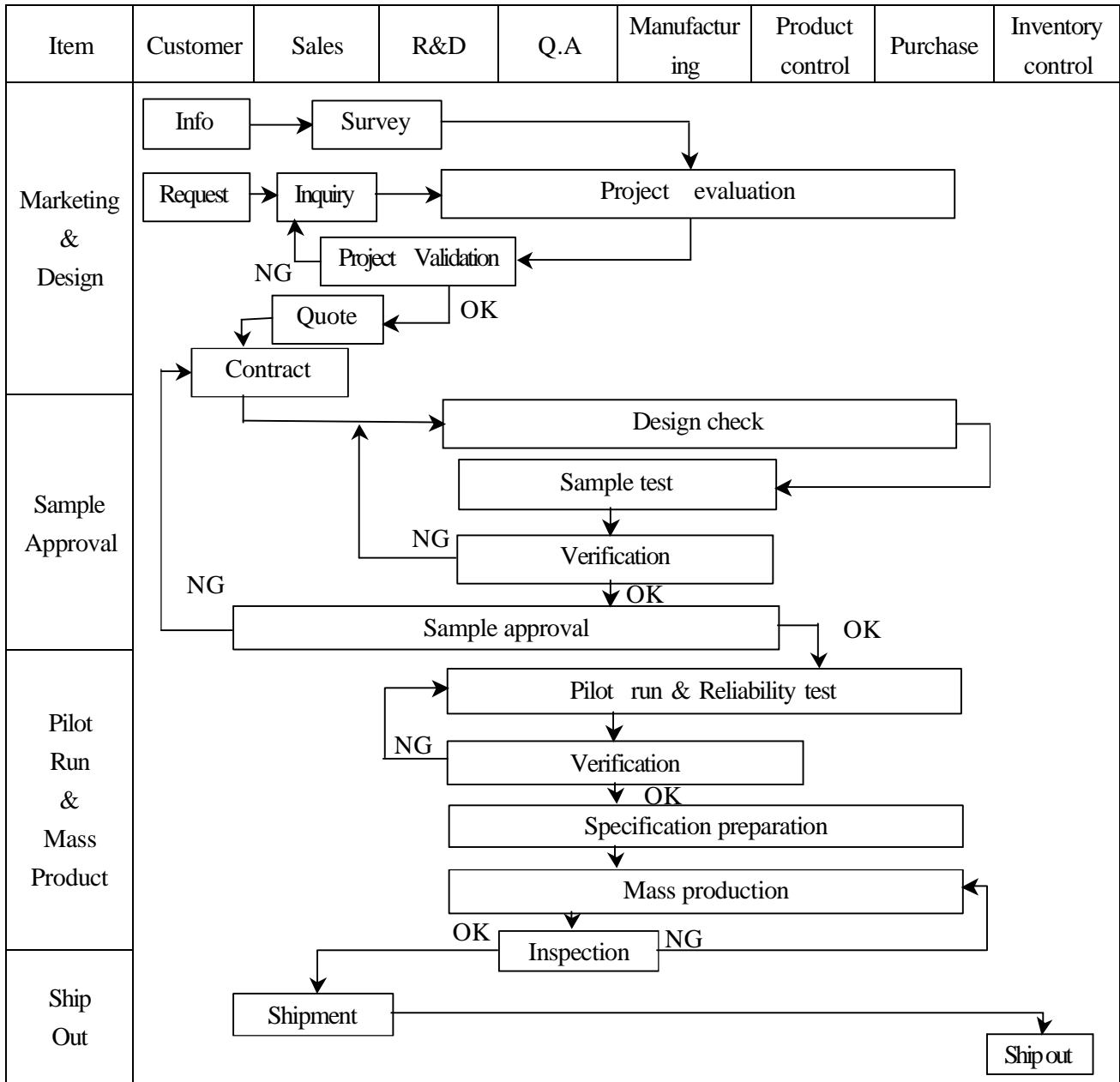Note 2:Correct input value for "N" is predetermined for each model.
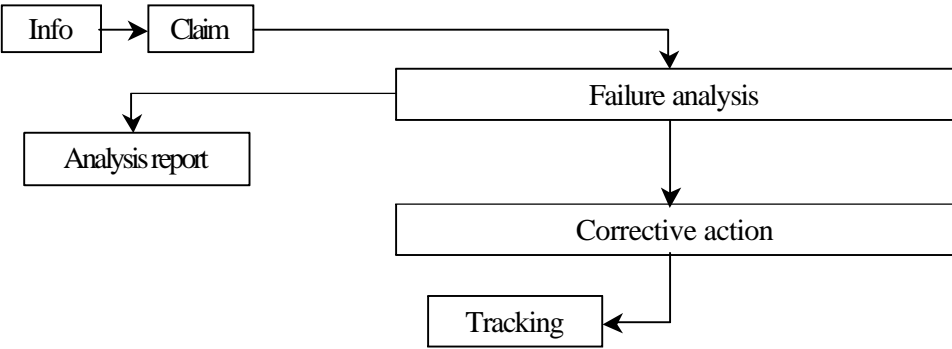
2.5 Character Pattern

■ CHARACTER PATTERN(SH/EH,NH)

3. QUALITY ASSURANCE SYSTEM

3.1 Quality Assurance Flow Chart

Item	Customer	Sales	R&D	Q.A	Manufacturing	Product control	Purchase	Inventory control
Marketing & Design	Info → Survey / Request → Inquiry → Project evaluation; Project Validation (NG / OK); Quote → Contract							
Sample Approval	Design check → Sample test → Verification (NG / OK) → Sample approval (OK)							
Pilot Run & Mass Product	Pilot run & Reliability test → Verification (NG / OK) → Specification preparation → Mass production → Inspection (OK / NG)							
Ship Out	Shipment / Ship out							

Item	Customer	Sales	R&D	Q.A	Manufacturing	Product control	Purchase	Inventory control
Sales Service	Info → Claim Analysis report			Failure analysis Corrective action Tracking				
Q.A Activity	1. ISO 9001 Maintenance Activities 2. Process improvement proposal 3. Equipment calibration 4. Education And Training Activities 5. Standardization Management							

3.2 Inspection Specification

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

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

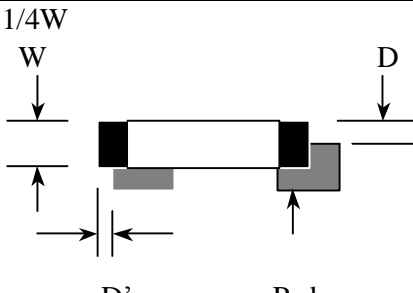IQC Defect Level：Major Defect AQL 0.4; Minor Defect AQL 1.5。

FQC Defect Level：100% Inspection。

OUT Going Defect Level：Sampling。

Specification：

NO	Item	Specification	Judge	Level
1	Part Number	The part number is inconsistent with work order of production	N.G.	Major
2	Quantity	The quantity is inconsistent with work order of production	N.G.	Major
3	Electronic characteristics of LCM $A=(L+W)\div 2$	The display lacks of some patterns.	N.G.	Major
		Missing line.	N.G.	Major
		The size of missing dot, A is＞1/2 Dot size	N.G.	Major
		There is no function.	N.G.	Major
		Output data is error	N.G.	Major
4	Appearance of LCD $A=(L+W)\div 2$ Dirty particle (Including scratch、bubble)	Material is different with work order of production	N.G.	Major
		LCD is assembled in inverse direction	N.G.	Major
		Bezel is assembled in inverse direction	N.G.	Major
		Shadow is within LCD viewing area + 0.5 mm	N.G.	Major
		The diameter of dirty particle, A is＞0.4 mm	N.G.	Minor
		Dirty particle length is ＞3.0mm, and 0.01mm＜width ≦0.05mm	N.G.	Minor
		Display is without protective film	N.G.	Minor
		Conductive rubber is over bezel 1mm	N.G.	Minor
		Polarizer exceeds over viewing area of LCD	N.G.	Minor
		Area of bubble in polarizer, A＞1.0mm, the number of bubble is ＞1 piece.	N.G.	Minor
		0.4mm＜Area of bubble in polarizer, A＜1.0mm, the number of bubble is ＞4 pieces.	N.G.	Minor
5	Appearance of PCB $A=(L+W)\div 2$	Burned area or wrong part number is on PCB	N.G.	Major
		The symbol, character, and mark of PCB are unidentifiable.	N.G	Minor
		The stripped solder mask , A is＞1.0mm	N.G.	Minor
		0.3mm＜stripped solder mask or visible circuit, A ＜1.0mm, and the number is ≧4 pieces	N.G.	Minor
		There is particle between the circuits in solder mask	N.G	Minor
		The circuit is peeled off or cracked	N.G	Minor
		There is any circuits risen or exposed.	N.G	Minor
		0.2mm＜Area of solder ball, A is ≦0.4mm The number of solder ball is ≧3 pieces	N.G	Minor
		The magnitude of solder ball, A is ＞0.4mm.	N.G	Minor

NO	Item	Specification	Judge	Level
6	Appearance of molding A=(L + W)÷2	The shape of modeling is deformed by touching.	N.G.	Major
		Insufficient epoxy: Circuit or pad of IC is visible	N.G.	Minor
		Excessive epoxy: Diameter of modeling is ＞20mm or height is ＞2.5mm	N.G.	Minor
		The diameter of pinhole in modeling, A is ＞0.2mm.	N.G.	Minor
7	Appearance of frame A=(L + W)÷2	The folding angle of frame must be ＞45　+10	N.G.	Minor
		The area of stripped electroplate in top-view of frame, A is ＞1.0mm.	N.G.	Minor
		Rust or crack is (Top view only)	N.G.	Minor
		The scratched width of frame is ＞0.06mm. (Top view only)	N.G.	Minor
8	Electrical characteristic of backlight A=(L + W)÷2	The color of backlight is nonconforming	N.G.	Major
		Backlight can't work normally.	N.G.	Major
		The LED lamp can't work normally	N.G.	Major
		The unsoldering area of pin for backlight, A is ＞1/2 solder joint area.	N.G.	Minor
		The height of solder pin for backlight is ＞2.0mm	N.G.	Minor
10	Assembly parts A=(L + W)÷2	The mark or polarity of component is unidentifiable.	N.G.	Minor
		The height between bottom of component and surface of the PCB is floating ＞0.7mm	N.G.	Minor
		D＞1/4W D'　　　Pad	N.G.	Minor
		End solder joint width, D' is ＞50% width of component termination or width of pad	N.G.	Minor
		Side overhang, D is ＞25% width of component termination.	N.G.	Minor
		Component is cracked, deformed, and burned, etc.	N.G.	Minor
		The polarity of component is placed in inverse direction.	N.G.	Minor
		Maximum fillet height of solder extends onto the component body or minimum fillet height is ＜0.5mm.	N.G.	Minor

![POWERTIP logo]

4. RELIABILITY TEST

4.1 Reliability Test Condition

NO	Item	Test Condition	
1	High Temperature Storage	Storage at 80 ±2℃ 96~100 hrs Surrounding temperature, then storage at normal condition 4hrs	
2	Low Temperature Storage	Storage at -30 ±2℃ 96~100 hrs Surrounding temperature, then storage at normal condition 4hrs	
3	High Temperature /Humidity Storage	1.Storage 96~100 hrs 60±2℃, 90~95%RH surrounding 　temperature, then storage at normal condition 4hrs. 　(Excluding the polarizer). or 2.Storage 96~100 hrs 40±2℃, 90~95%RH surrounding 　temperature, then storage at normal condition 4 hrs.	
4	Temperature Cycling	-20℃ → 25℃ → 70℃ → 25℃ (30mins) (5mins) (30mins) (5mins) 10 Cycle	
5	Vibration	10~55Hz (1 minute) 1.5mm X,Y and Z direction ＊ (each 2hrs)	
6	ESD Test	Air Discharge: Apply 6 KV with 5 times discharge for each polarity +/- Testing location: Around the face of LCD	Contact Discharge: Apply 250V with 5 times discharge for each polarity +/- Testing location: 1.Apply to bezel. 2.Apply to Vdd, Vss.
7	Drop Test	Packing Weight (Kg)	Drop Height (cm)
		0 ~ 45.4	122
		45.4 ~ 90.8	76
		90.8 ~ 454	61
		Over 454	46

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 $280\pm10^{\circ}\text{C}$ 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°C $\pm5^{\circ}\text{C}$ 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 electronicequipment , 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.