POWERTIP TECH. CORP.

SPECIFICATIONS

CUSTOMER	:	
SAMPLE CODE (Ver.)	:	
MASS PRODUCTION CODE (Ver.)	:	**PC1602LRS-KNH-BY4Q (Ver.0)**
DRAWING NO. (Ver.)		**DMD-08009 (Ver.0)**

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.

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RECORDS OF REVISION

Date	Ver.	Description	Page	Desig n by
2008/2/1	0	PC1602LRS-KNH-BY4Q is the ROHS compliant part number based on Powertip's standard PC1602LRS-KNH-B-Y4		

Total：23 Page

Contents

Note：For detailed information please refer to IC data sheet：ST7066U,ST7065C

1. SPECIFICATIONS

1.1 Features

Item	Standard Value
Display Type	16*2 Characters
LCD Type	STN gray Positive Transflective Normal Temp.
Driver Condition	LCD Module：1/16 Duty，1/5 Bias
Viewing Direction	6 O'clock
Backlight	YG LED B/L
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	53.0(L) * 20.0(w) * 8.6(H)(Max)	mm
Viewing Area	36.0(L) * 10.0(w)	mm
Active Area	34.1(L) * 7.4(w)	mm
Dot Size	0.33(L) * 0.35(w)	mm
Dot Pitch	0.38(L) * 0.40(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}-10.0	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	℃
Storage Temperature	T_{ST}	Excluded B/L	-20	70	℃
Storage Humidity	H_D	Ta＜40 ℃	-	90	%RH

1.4 DC Electrical Characteristics

V_{DD} = 5.0 V ± 10%，V_{SS} = 0V，Ta = 25℃

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage	V_{DD}	—	4.5	5.0	5.5	V
"H" Input Voltage	V_{IH}	—	0.7 V_{DD}	-	V_{DD}	V
"L" Input Voltage	V_{IL}	—	-0.3	-	0.6	V
"H" Output Voltage	V_{OH}	I_{OH}=-0.1mA	3.9	-	V_{DD}	V
"L" Output Voltage	V_{OL}	I_{OL}=0.1mA	-	-	0.4	V
Supply Current	I_{DD}	V_{DD} = 5.0 V	-	1.5	3.0	mA
LCM Driver Voltage	V_{OP}	0℃	-	-	-	V
		25℃ *1	4.2	4.4	4.6	
		50℃	-	-	-	

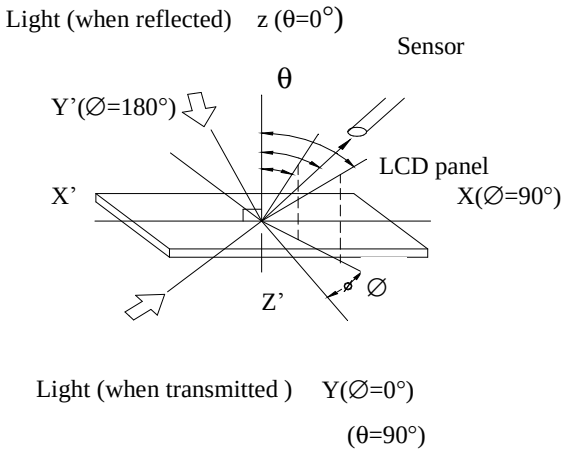
Note: *1. THE V_{OP} TEST POINT IS V_{DD} - V_O.

1.5 Optical Characteristics

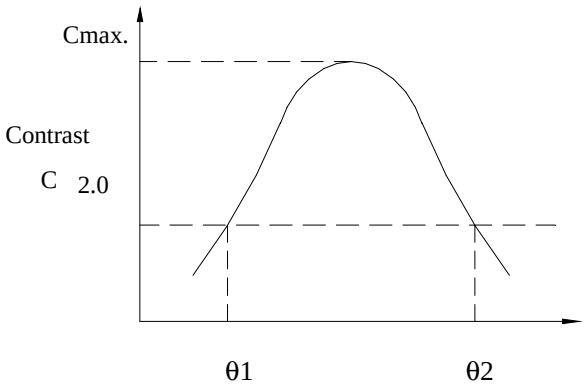
LCD Panel：1/16 Duty，1/5 Bias，V_{LCD} =4.67 V，Ta = 25℃

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

Note 1: Definition of angles θ and ∅



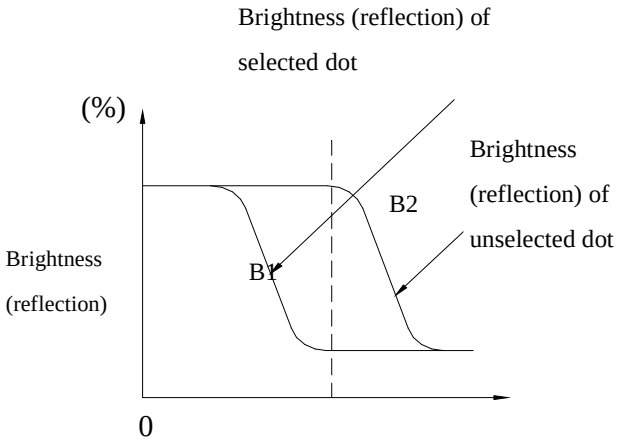
Note 2: Definition of viewing angles θ1 and θ2



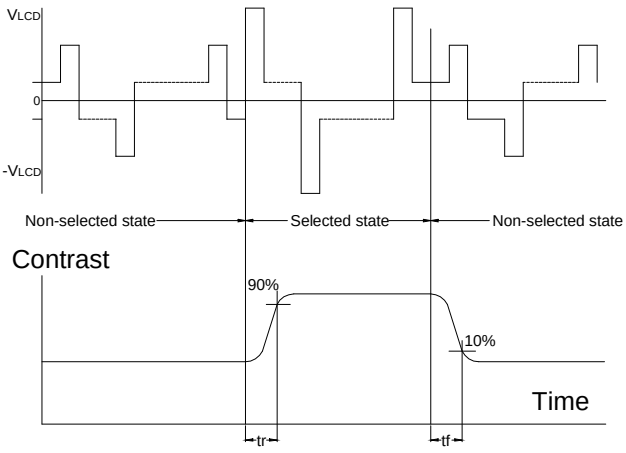
Note : Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same

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)

1.6 Backlight Characteristics

LCD Module with LED Backlight

Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Forward Current	IF	Ta =25℃	-	40	mA
Reverse Voltage	VR	Ta =25℃	-	8	V
Power Dissipation	PO	Ta =25℃	-	0.19	W

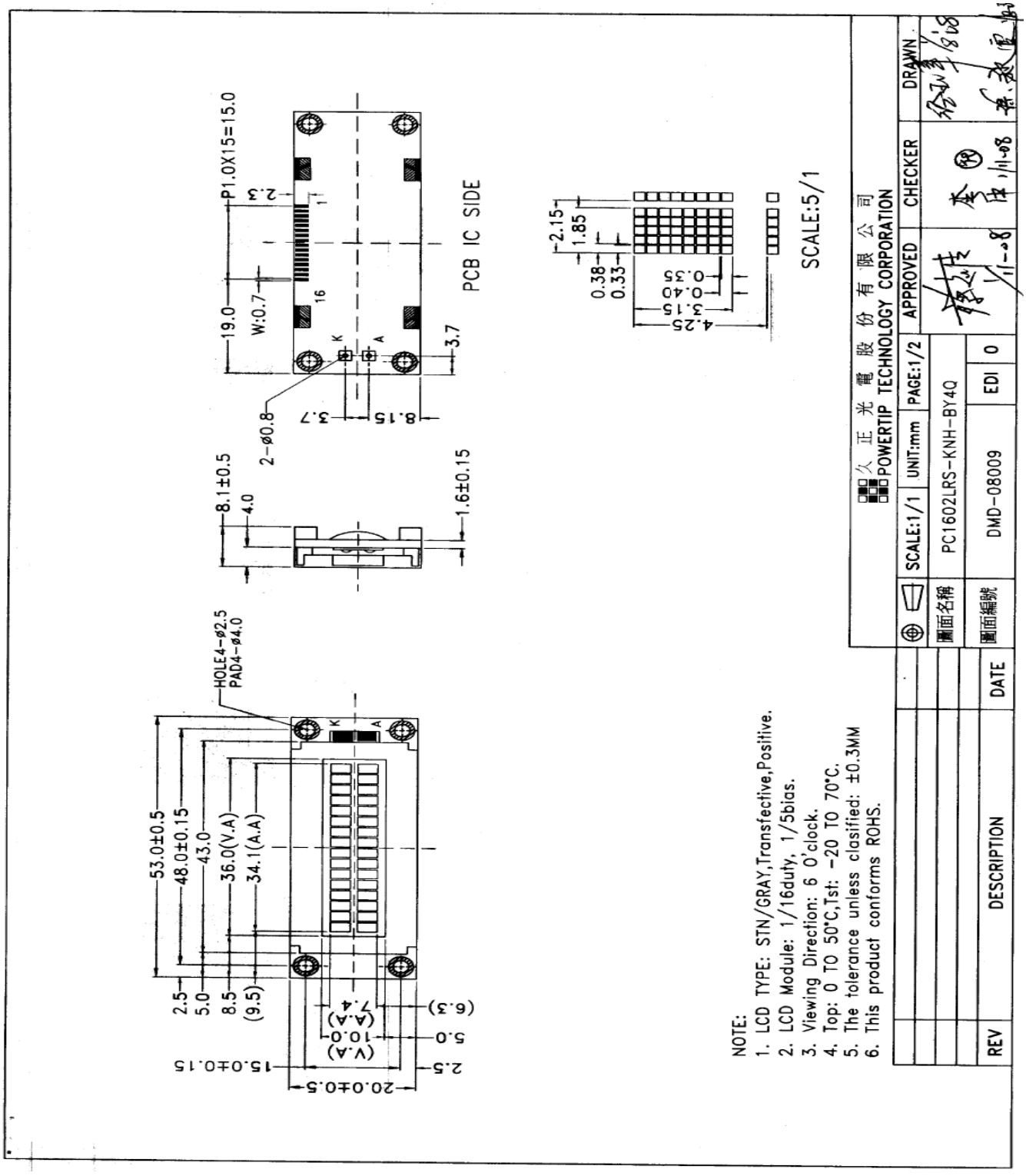
Electrical / Optical Characteristics

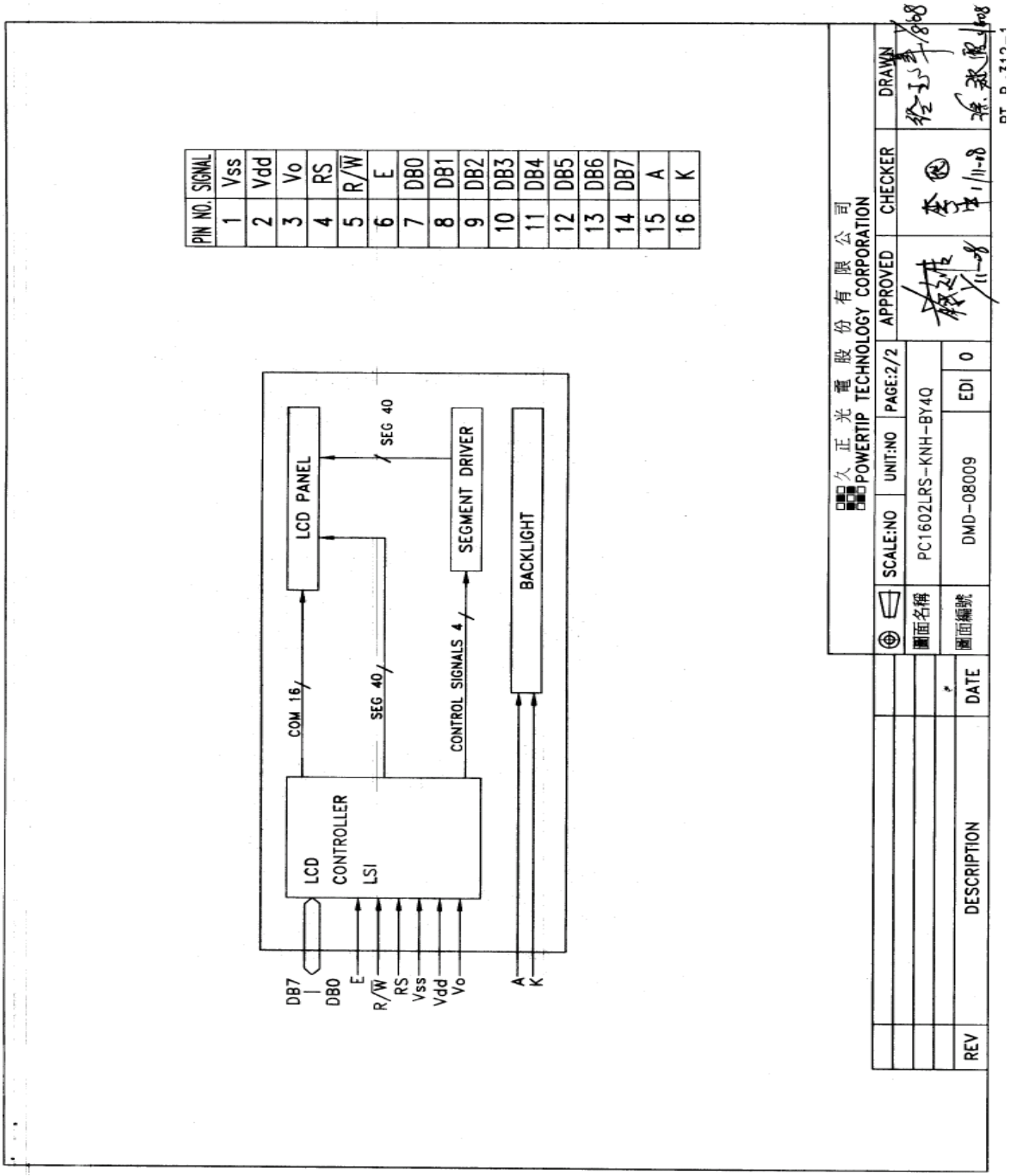
Ta =25℃

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Forward Voltage	VF	IF= 28 mA	-	4.2	4.8	V
Reverse Current	IR	VR= 8 V	-	-	0.2	mA
Wavelength	λp	IF= 28 mA	565	-	571	nm
Luminous Intensity (without LCD)	Iv	IF= 28 mA	4	5	-	cd/m^2
Color	Yellow-green					

2. MODULE STRUCTURE

2.1 Counter Drawing

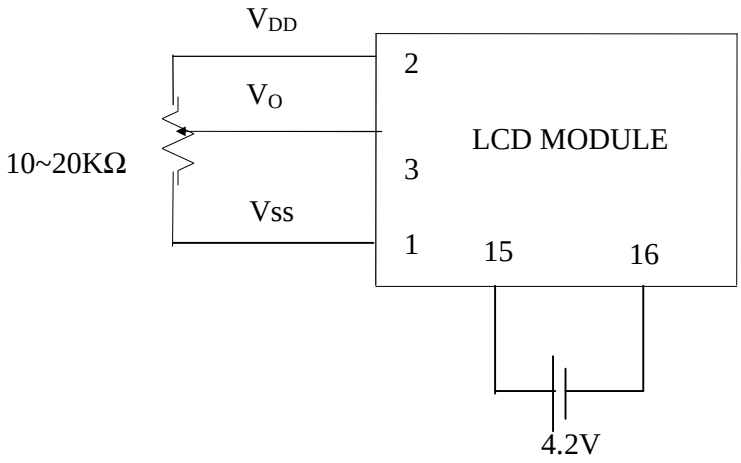




2.2 Interface Pin Description

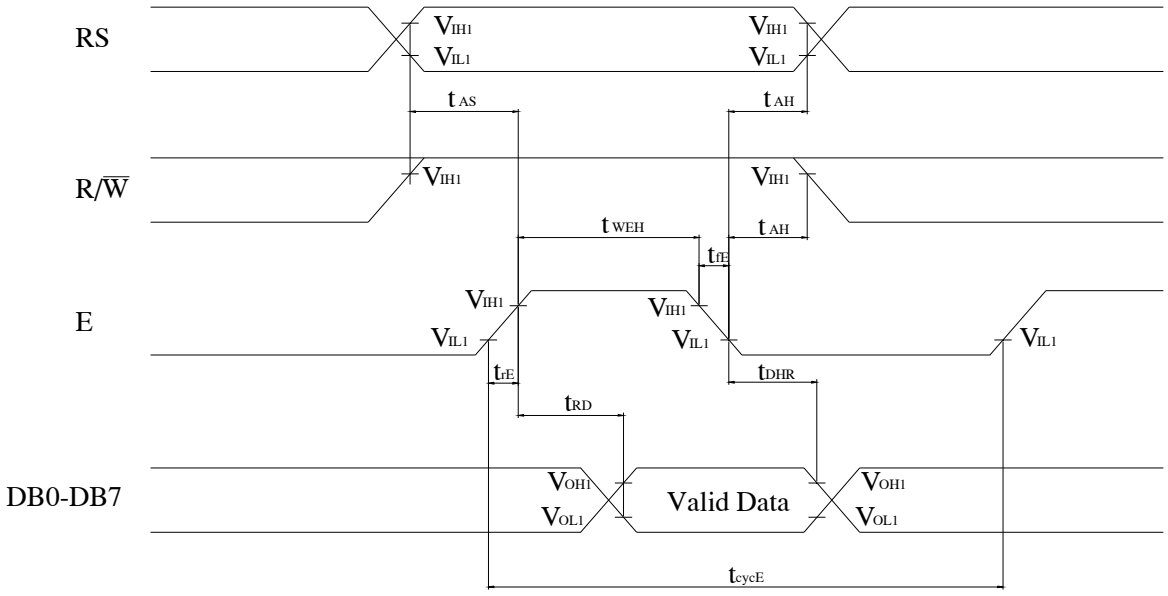
Pin No.	Symbol	Function
1	Vss	Signal ground (GND)
2	VDD	Power Supply for logic (VDD> Vss)
3	VO	Operating Voltage for LCD (variable)
4	RS	Register selection input High = Data register Low = Instruction register (for write) Busy flag address counter (for read)
5	— R/W	R/W signal input is used to select 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.
15	A	Power supply LED backlight (+)
16	K	Power supply LED backlight (-)

Contrast Adjust

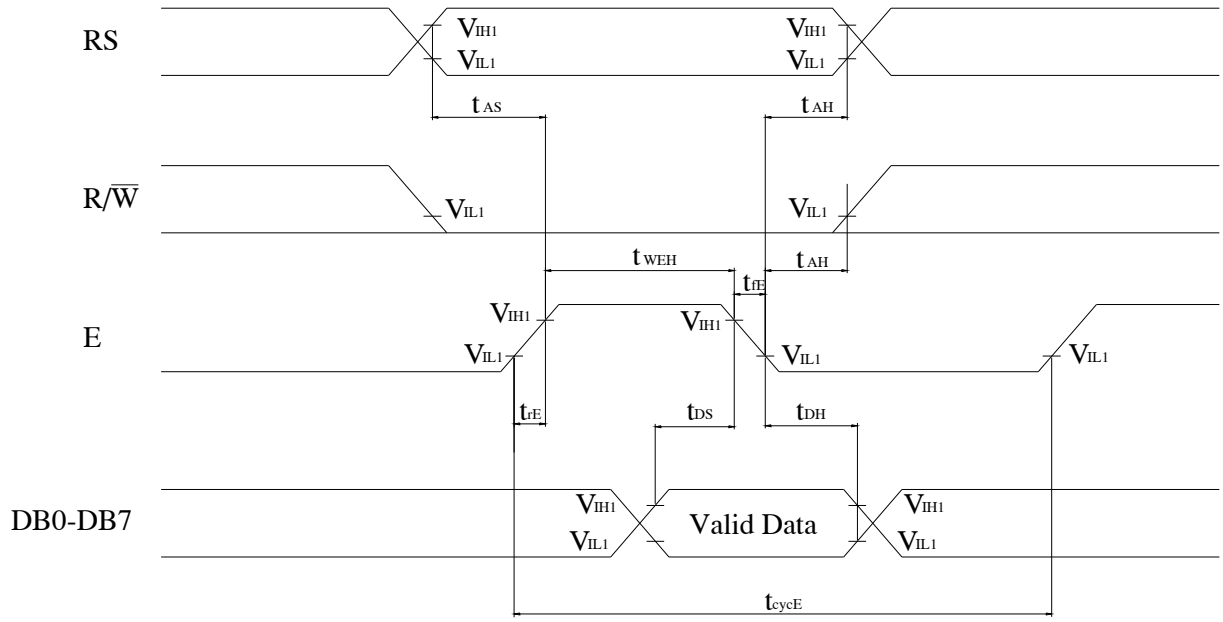


2.3 Timing Characteristics

- Read cycle



- Write cycle



• Read cycle

V_{DD}=5.0V±10%,VSS=0V,Ta=25℃

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]	-	-	ns
			100[2]			
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]	-	-	ns
			100[2]			
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

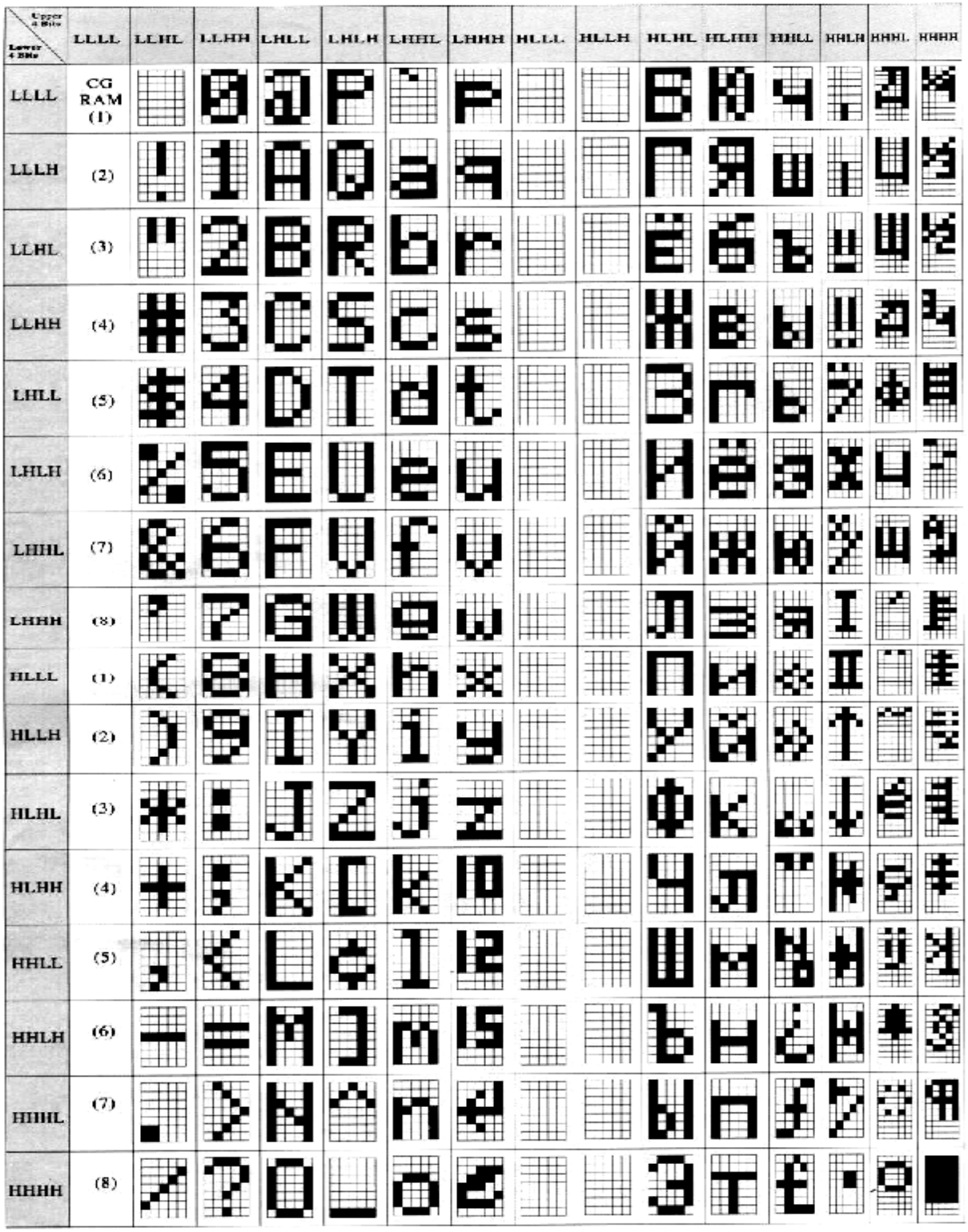
Instructions	Instruction Code										Description	Execution Time(max) (f_{osc}= 250KHZ)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Clear entire display area, restore display from shift, and load address counter with DD RAM address 00H	1.64ms
Display/ Cursor Home	0	0	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.

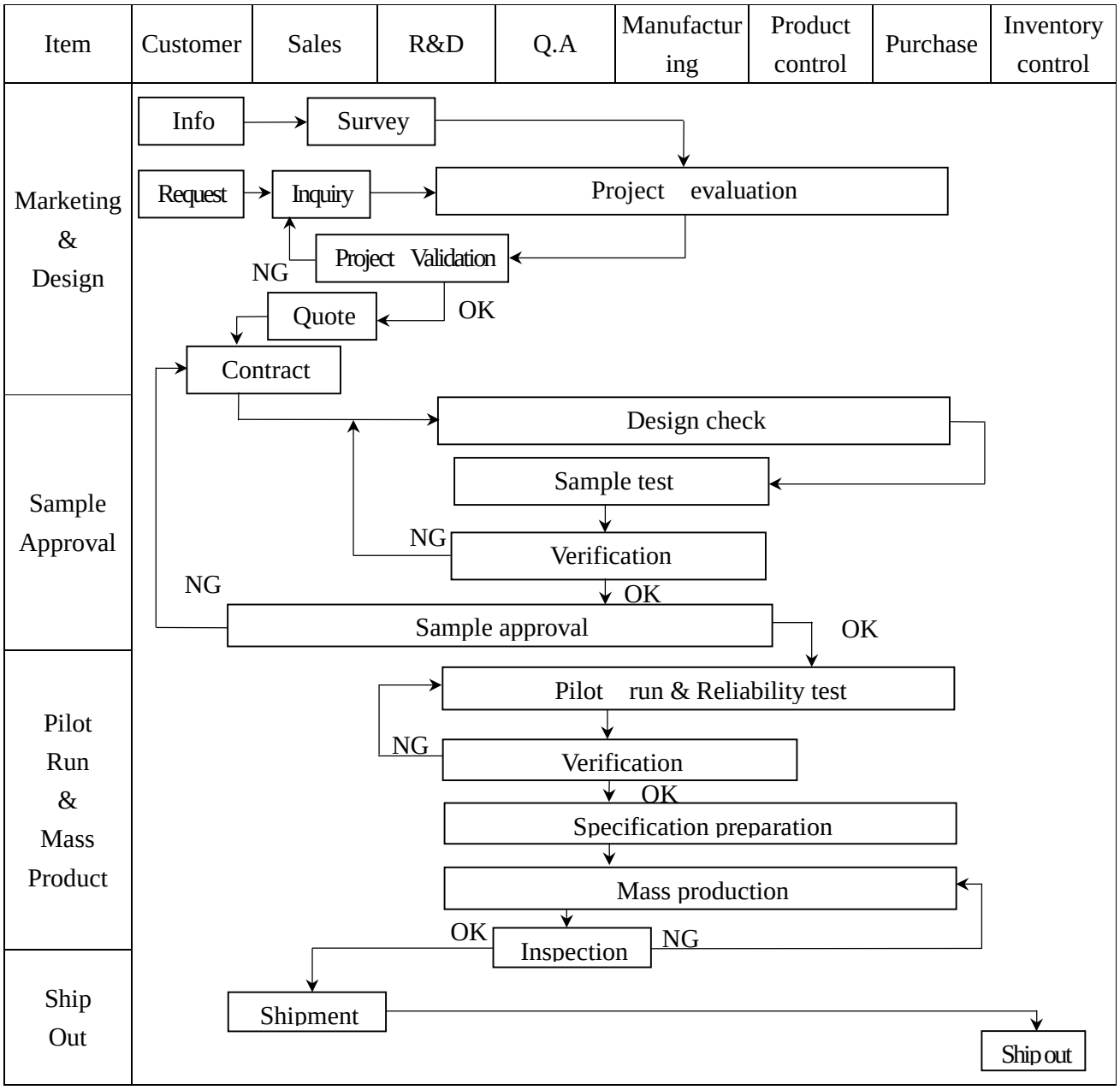
2.5 Character Pattern

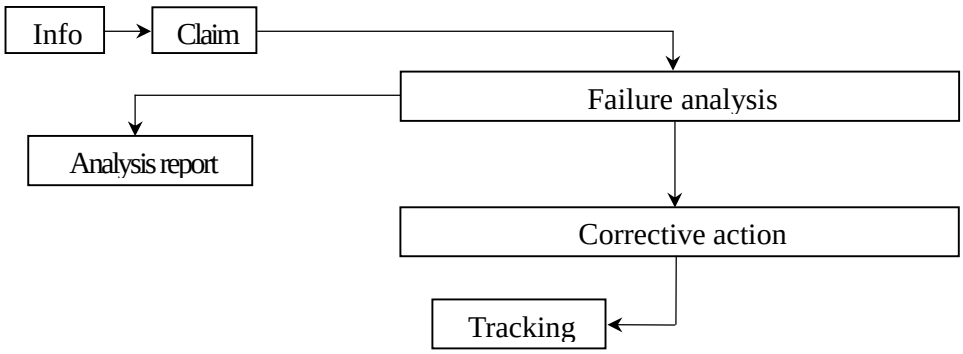
■ CHARACTER PATTERN(SH/EH,NH)



3. QUALITY ASSURANCE SYSTEM

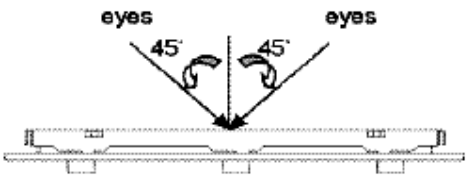
3.1 Quality Assurance Flow Chart

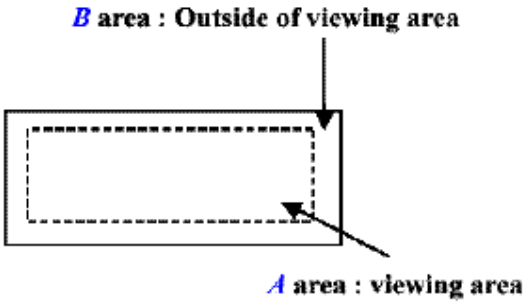


Item	Customer	Sales	R&D	Q.A	Manufacturing	Product control	Purchase	Inventory control
Sales Service								
Q.A Activity	1. ISO 9001 Maintenance Activities 2. Process improvement proposal 3. Equipment calibration 4. Education And Training Activities 5. Standardization Management							

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)

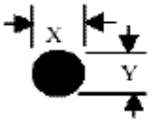


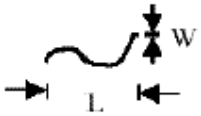


◆ Specification:

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 : • White and black spots on display ≦ 0.30mm, no more than Four white or black spots present. • Densely spaced : NO more than two spots or lines within 3mm	Minor

◆Specification :

<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>level</th></tr>
<tr><td>05</td><td>Black or white dot、scratch、contamination
Round type
 

Φ=(x+y)/2
 
</td><td>5.1.2 Nom-display :
<table><tr><td>Dimension (diameter : Φ)</td><td>Acceptance(Q'ty)</td></tr><tr><td>Φ ≦0.10mm</td><td>Accept no dense</td></tr><tr><td>0.10mm＜Φ ≦0.20mm</td><td>3</td></tr><tr><td>0.20mm＜Φ ≦0.30mm</td><td>2</td></tr><tr><td>Total</td><td>4</td></tr></table>5.1.3 Line type:
<table><tr><td colspan="2">Dimension (diameter : Φ)</td><td colspan="2">Acceptance (Q'ty)</td></tr><tr><td>Length</td><td>width</td><td>A area</td><td>B area</td></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></td><td>Minor</td></tr>
<tr><td>06</td><td>Polarizer Bubble</td><td><table><tr><td rowspan="2">Dimension (diameter : Φ)</td><td colspan="2">Acceptance(Q'ty)</td></tr><tr><td>A area</td><td>B area</td></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></td><td>Minor</td></tr>
<tr><td>07</td><td>The crack of glass</td><td>● Glass Crack:
7.1 Crack on the circuit of electrode terminal :
 

<table><tr><td></td><td>X</td><td>Y</td><td>Z</td></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></td><td>Minor</td></tr>
</table>

◆Specification :

<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>Level</th></tr>
<tr><td rowspan="2">07</td><td rowspan="2">The crack of glass

X: The length of Crack

Y: The width of crack

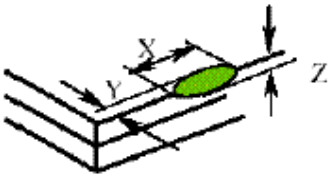
Z: The thickness of crack

D: terminal length

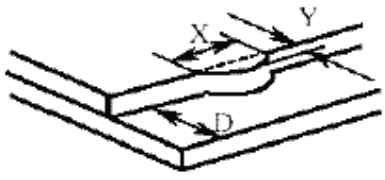
T: The thickness of glass

A : The length of glass</td><td>● Glass Crack:

7.2 General glass crack and corner edge:

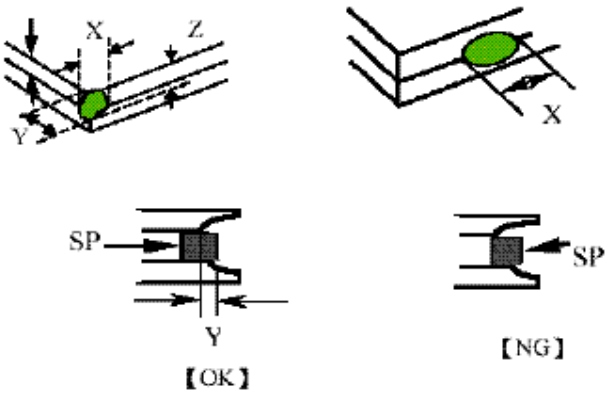
7.2.1
 

<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>
7.2.2
 

<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></td><td>Minor</td></tr>
<tr><td>7.3 Glass remain:
 

<table><tr><td>X</td><td>Y</td></tr><tr><td>Neglect</td><td>≦ 1/3 d</td></tr></table></td><td>Minor</td></tr>
</table>

◆Specification :

<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>Level</th></tr>
<tr><td>07</td><td>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</td><td>7.4 Corner crack and medial crack:
 

<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≦1/5a</td><td>Crack can’t enter viewing area</td><td>≦1/2t</td></tr>
<tr><td>≦1/5a</td><td>Crack can’t exceed the half of width of SP width of SP</td><td>1/2t<Z≦2t</td></tr>
</table></td><td>Minor</td></tr>
<tr><td>08</td><td>Backlight elements</td><td>8.1 Backlight can’t work normally.</td><td>Major</td></tr>
<tr><td></td><td></td><td>8.2 Backlight doesn’t light or color is wrong.</td><td>Major</td></tr>
<tr><td></td><td></td><td>8.3 Illumination source flickers when lit.</td><td>Major</td></tr>
<tr><td>09</td><td>General appearance</td><td>9.1 pin type must match type in specification sheet</td><td>Major</td></tr>
<tr><td></td><td></td><td>9.2 No short circuits in components on PCB or FPC</td><td>Major</td></tr>
<tr><td></td><td></td><td>9.3Product packaging must the same as specified on packaging specification sheet.</td><td>Major</td></tr>
<tr><td></td><td></td><td>9.4 The folding and peeled off in polarizer are not acceptable</td><td>Major</td></tr>
<tr><td></td><td></td><td>9.5 The PCB or FPC between B/L assembled distance (PCB or FPC) is ≦1.5mm</td><td>Major</td></tr>
</table>

4. RELIABILITY TEST

4.1 Reliability Test Condition

<table>
<tr><th>NO.</th><th>TEST ITEM</th><th colspan="2">TEST CONDITION</th></tr>
<tr><td>1</td><td>High Temperature Storage Test</td><td colspan="2">Keep in 70 ±2℃ 96 hrs
Surrounding temperature, then storage at normal condition 4hrs</td></tr>
<tr><td>2</td><td>Low Temperature Storage Test</td><td colspan="2">Keep in -20 ±2℃ 96 hrs
Surrounding temperature, then storage at normal condition 4hrs</td></tr>
<tr><td>3</td><td>High Humidity Storage</td><td colspan="2">Keep in +40℃/90%RH duration for 96 hrs
Surrounding temperature, then storage at normal condition 4hrs
(Excluding the polarizer)</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">ESD Test</td><td>Air Discharge:
Apply 6 KV with 5 times
Discharge for each polarity +/-</td><td>Contact Discharge:
Apply 250V with 5 times
discharge for each polarity +/-</td></tr>
<tr><td colspan="2">1. Temperature Ambient: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%)</td></tr>
<tr><td>5</td><td>Temperature Cycling Test</td><td colspan="2">-20℃ → 25℃ → 70℃ → 25℃
(30mins) (5mins) (30mins) (5mins)
10 Cycle
Surrounding temperature, then storage at normal condition 4hrs</td></tr>
<tr><td>6</td><td>Vibration Test (Packaged)</td><td colspan="2">1. Sine wave 10～55HZ frequency (1 min)
2. The amplitude of vibration :1.5 mm
3. Each direction (XYZ) duration for 2 Hrs</td></tr>
<tr><td>7</td><td>Drop Test (Packaged)</td><td colspan="2"><table><tr><th>Packing Weight (Kg)</th><th>Drop Height (cm)</th></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</td></tr>
</table>

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±10℃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℃ ±5℃ 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.

6. PACKING Specification

LCM Model	PC1602LRS-KNH-BY4Q
Drawing NO.	DPK-07882

LCM包裝規格書
LCM Packaging Specifications

Approve	Check	Contact
DATE	初版	版次Ver
07'12'25	07'12'25	0

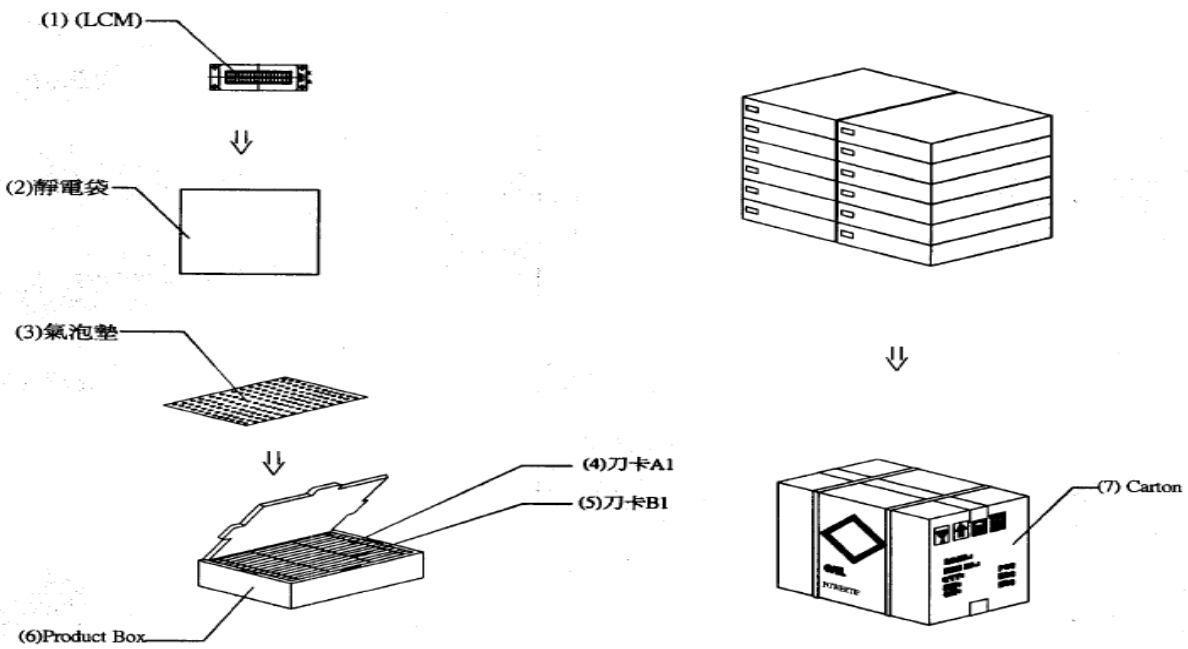
1.包裝材料規格表 (Packaging Material) : (per carton)

No.	Item	Model	Dimensions (mm)	Quantity
1	成品(1) LCM	PC1602LRS-KNH-BY4Q	(53.0*20.0*8.1)	540
2	靜電袋 (2)BAG	BAG100100ARABA	100*100*0.05	540
3	氣泡墊(3)BAG	BAG290240BRBBA	240*290*5	24
4	刀卡A1(4)BX	BX29500047BZBA	295*47*3	168
5	刀卡B1(5)BX	BX24500047BZBA	245*47*4.5	48
6	C1內盒(6)Product Box	BX31025555AABA	310*255*55	12
7	外紙箱(7)Carton	BX52532536CCBA	525*325*360	1
8				
9				

2.單箱數量規格表 (Packaging Specifications and Quantity) :

(1)LCM quantity per box : no. per box 15 x no. of box 3 = 45

(2)Total LCM quantity in carton : quantity per box 45 x no. of boxes 12 = 540



特 記 事 項 (REMARK)

1. Label Specifications :

MODEL:
LOT NO:
QUANTITY:
CHECK:

最外一欄LCD面朝里,其餘LCD面朝外,CB pin朝下),45PCS/盒

POWERTIP TECH. CORP.