POWERTIP TECH. CORP.

DISPLAY DEVICES FOR BETTER ELECTRONIC DESIGN

Specification For Approval

Customer : RYSTON

Model Type : LCD Module

Sample Code : PC16020R-FSO-B-SB

Mass Production Code :

Edit : B

Customer Sign	Sales Sign	Approved By	Prepared By
		開發 88. 9. 17 魏潔怡	BRENDA 9/9/99

CONTENTS

1. SPECIFICATIONS

1.1 Features

- 16-characters, two-lines liquid crystal display of 5*8dot matrix + cursor
- 1/16 Duty, 1/4 bias
- TN LCD, positive, gray display
- Transflective LCD
- 6 o'clock viewing angle
- 8 bits parallel data input
- Built-in LED backlight

1.2 Mechanical Specifications

- Outline dimension : 84.0mm(L)* 44.0mm(W)*14.0mm max.(H)
- Viewing area : 61.0mm *15.8mm
- Active area : 56.21mm *11.5mm
- Dot size : 0.56mm *0.66mm
- Dot pitch : 0.60mm *0.70mm
- Character Size : 2.96mm *5.56mm

1.3 Absolute Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Power supply Voltage	VDD	-	0	6.5	V
LCD drive Supply voltage	VDD-VO	-	-	13	V
Input voltage	VIN	-	-0.3	VDD+0.3	V
Operating temperature	TOPR	-	0	50	°C
Storage temperature	TSTG	-	-20	+70	°C
Humidity*1	HD	-	-	90	%RH

1.4 DC Electrical Characteristics

VDD=+5V±10%,VSS=0V,TA=25°C

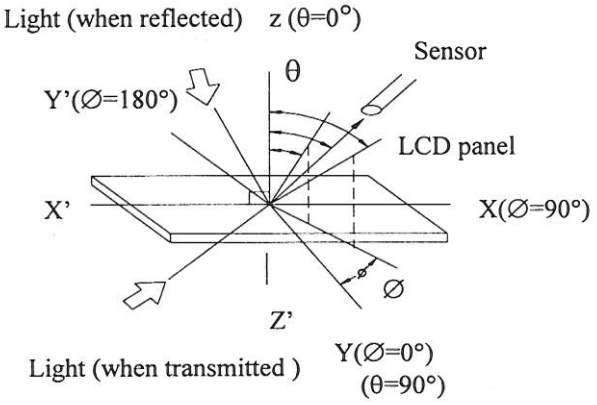
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply voltage	VDD	-	4.5	5	5.5	V
"H" input voltage	VIH	-	0.8VDD	-	VDD	V
"L" input voltage	VIL	-	0	-	0.2VDD	V
"H" output voltage	VOH	-	VDD-0.3	-	-	V
"L" output voltage	VOL	-	-	-	0.3	V
Supply current	IDD	VDD=5V	1.3	1.5	1.7	mA
LCD driving voltage	VOP	VDD-VO	3.6	4.2	4.4	V

1.5 Optical Characteristics

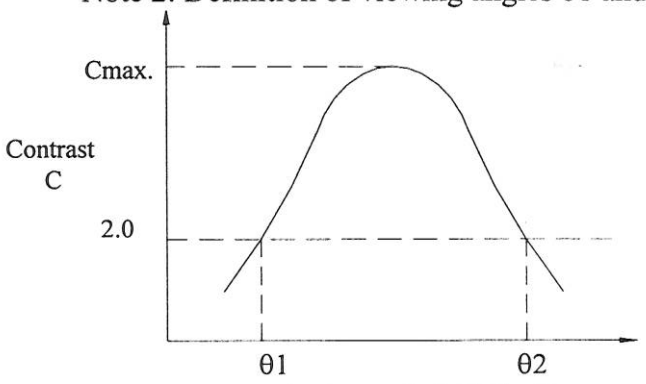
1/16 duty, 1/4 bias, Vopr=4.2V, Ta=25°C

Item	Symbol	Conditions	Min.	Typ.	Max	Reference
Viewing angle	θ	C≥2.0,∅=0°C	30°	-	-	Notes 1 & 2
Contrast	C	θ=5°, ∅=0°	3	4.5	-	Note 3
Response time(rise)	tr	θ=5°, ∅=0°	-	120ms	180ms	Note 4
Response time(fall)	tf	θ=5°, ∅=0°	-	250ms	400ms	Note 4

Note 1: Definition of angles θ and ∅



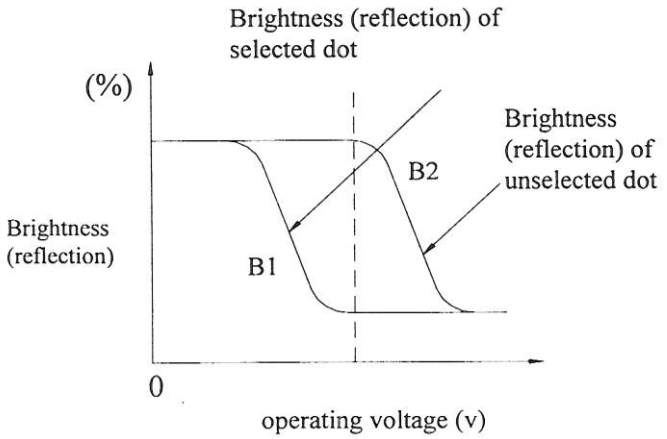
Note 2: Definition of viewing angles θ1 and θ2



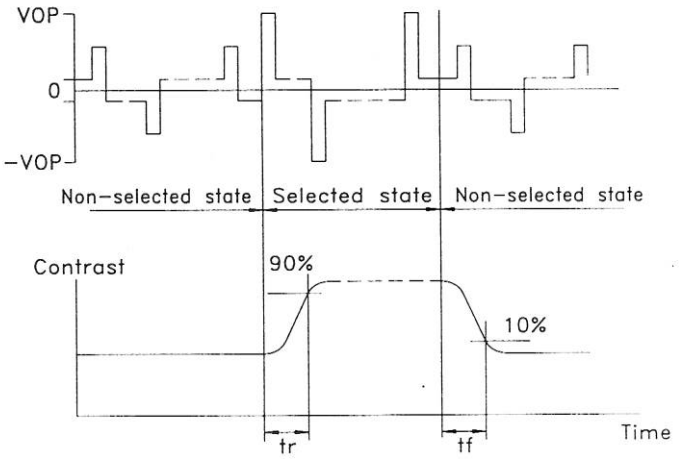
Note : Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same

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_{OPR} : Operating voltage
T_r : Response time (rise)
f_{FRM} : Frame frequency
t_f: Response time (fall)

1.6 Backlight Characteristic

The LCD Module is backlight using a edge LED panel

•.Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Forward current	IF	TA=25°C	-	300	mA
Reverse voltage	VR	TA=25°C	-	8	V
Power dissipation	PO	TA=25°C	-	1.38	W
Operating Temperature	TOPR	-	-20	70	°C
Storage temperature	TSTG	-	-40	80	°C

•.Electrical Ratings

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward voltage	VF	IF=360mA	-	4.0	4.4	V
Reverse current	IR	VR=8V	-	-	0.2	mA
Luminous intensity	IV	IF=360mA	-	90	-	cd/m^2
Wavelength	λp	IF=360mA	-	585	-	nm
Color	Orange					

2. MODULE STRUCTURE

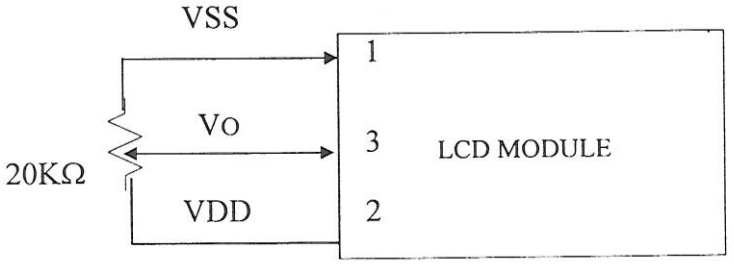
2.1 Counter Drawing

*See Appendix

2.2 Interface Pin Description

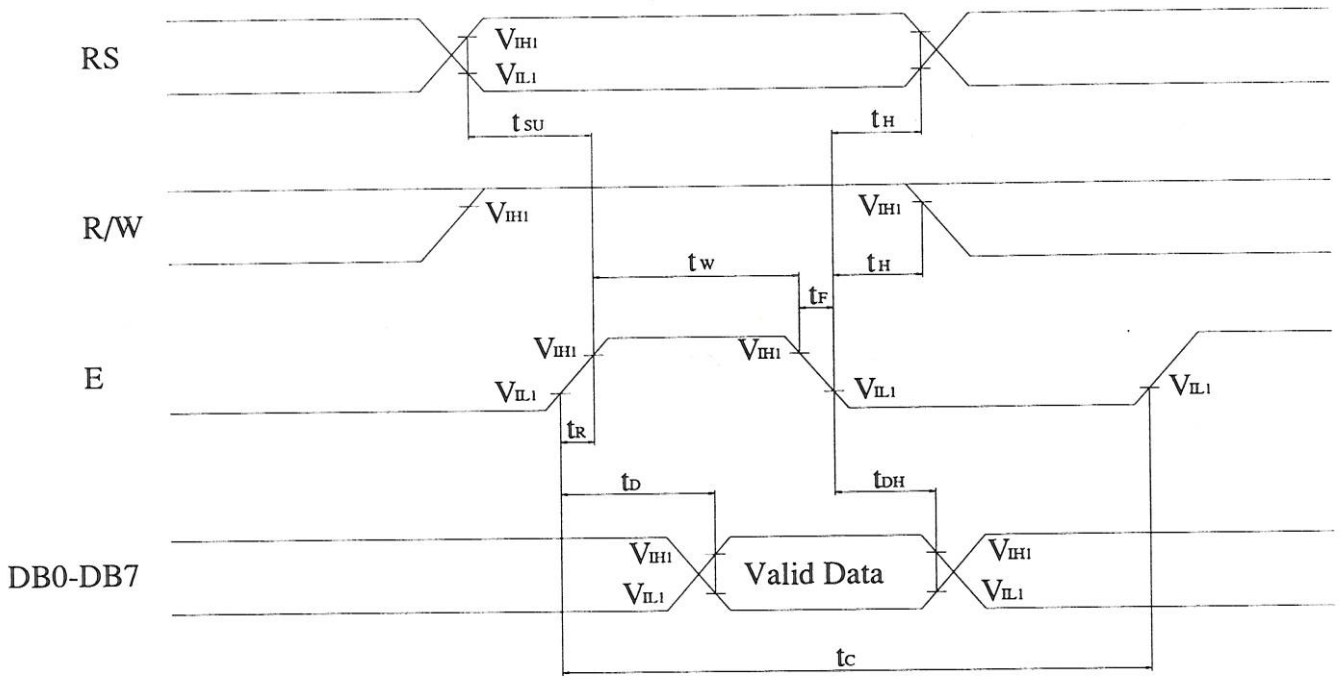
Pin No.	Symbol	Signal Description
1	VSS	Signal ground (GND)
2	VDD	Power Supply (5 V)
3	VO	Operating voltage (LCD Driver)
4	RS	Register Selection input High = Data register Low = Instruction register (for write) Busy flag address counter (for read)
5	R/W	Read/Write signal input is used to select the read/write 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. Use 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 for LED B / L (+)
16	K	Power supply for LED B / L (-)

Contrast Adjust

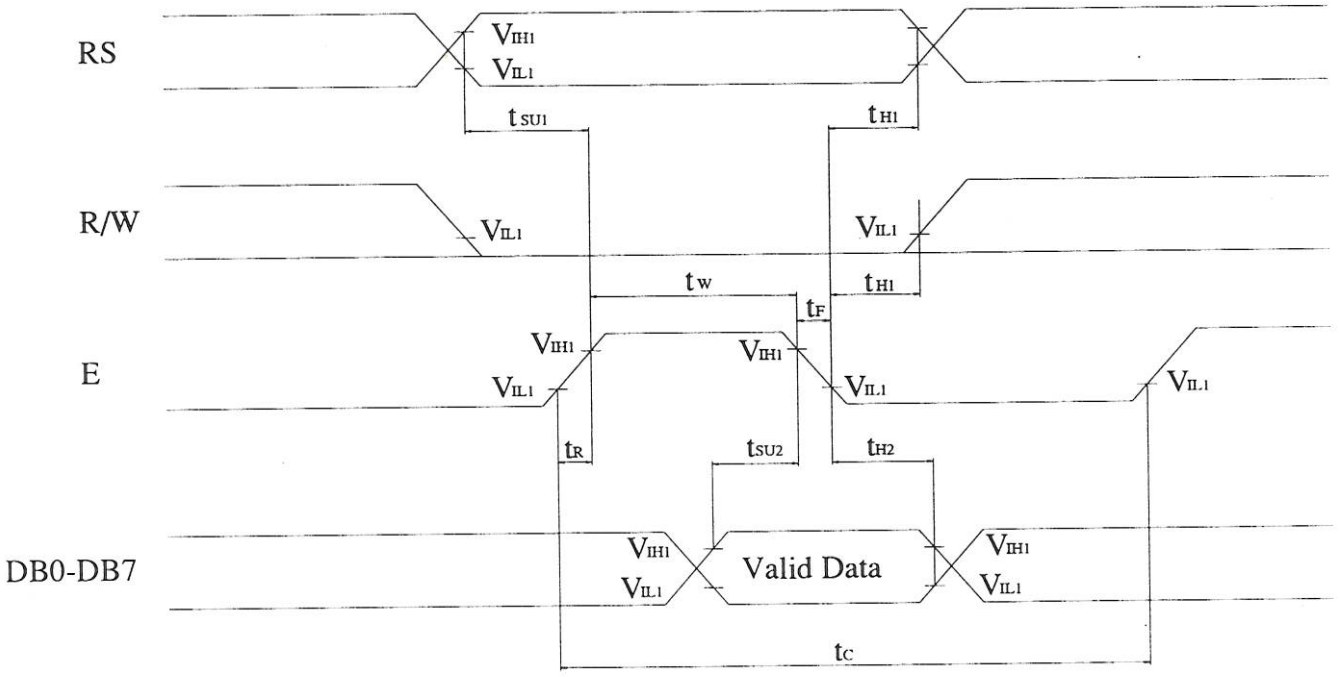


2.3 Timing Characteristics

• Read cycle



• Write cycle



• Read cycle

VDD=4.5V~5.5V,Ta=-30~+85℃

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

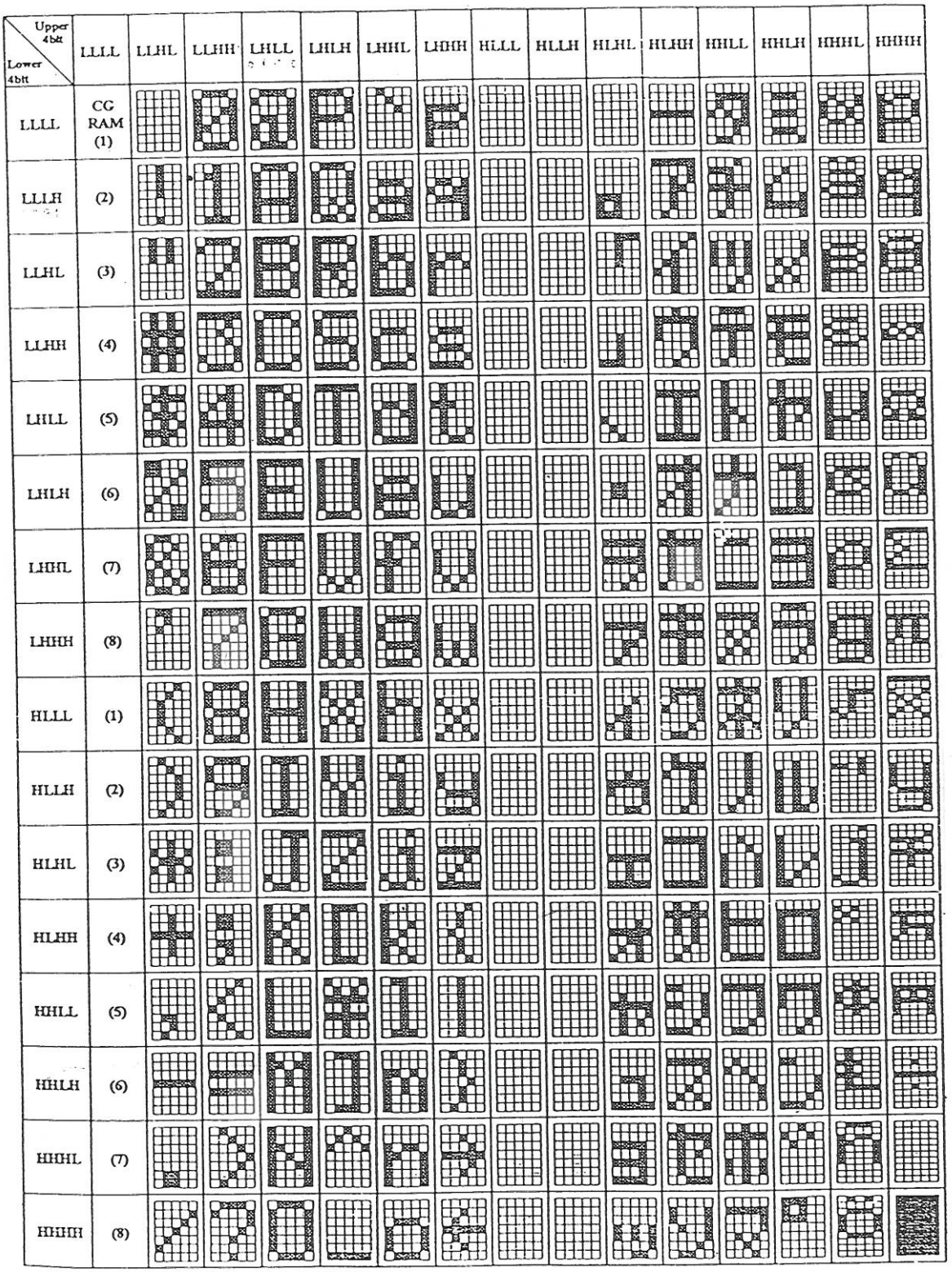
Characteristics	Symbol	Min.	Typ.	Max.	Unit
E Cycle Time	t_C	500	-	-	ns
E Rise / Fall Time	t_R,t_F	-	-	20	ns
E Pulse Width (High, Low)	t_W	230	-	-	ns
R/W and RS Setup Time	t_{SU1}	40	-	-	ns
R/W and RS Hold Time	t_{H1}	10	-	-	ns
Data Setup Time	t_{SU2}	80	-	-	ns
Data Hold Time	t_{H2}	10	-	-	ns

2.4 Display Command

Instructions	Instruction Code										Description	Execution Time (fosc = 270KHZ)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
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	SH	Assign cursor moving direction and make shift of entire display enable.	37μs
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Sets display (D), cursor(C), and blinking of cursor(B) on/off control bit.	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	×	×	Set interface data length (DL:4 - bit/8-bit), numbers of display line (N: 1-line/2-line), display font type(F:5*8 dots/5*11 dots)	37μs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	37μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	37μs
Read Busy Flag and Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0μs
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	43μs
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	43μs

※ "×":don't care

2.5 Character Pattern



Out Going Inspection Specification

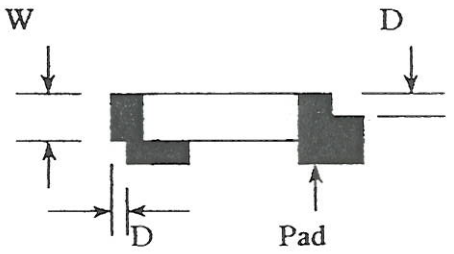
5-1. Inspection Standard : MIL-STD-105E Table Normal Inspection Single Sampling Level II

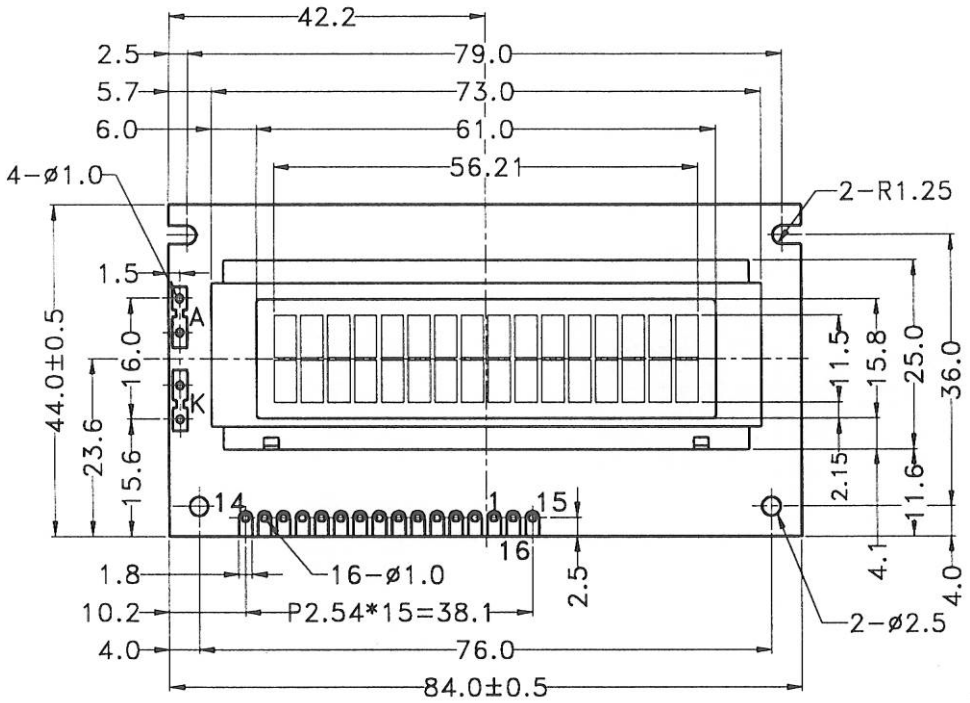
5-2. Defect Level : Major Defect AQL 1.0 ; Minor Defect AQL 2.5 。

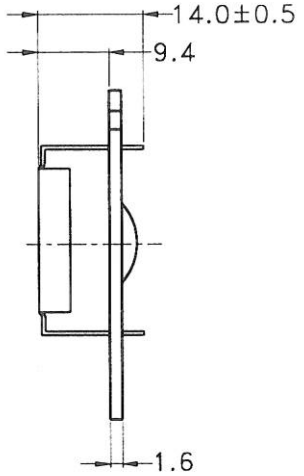
5-3. Equipment : Gauge 、MIL-STD 、Powertip Tester 、Sample 。

5-4. Specification :

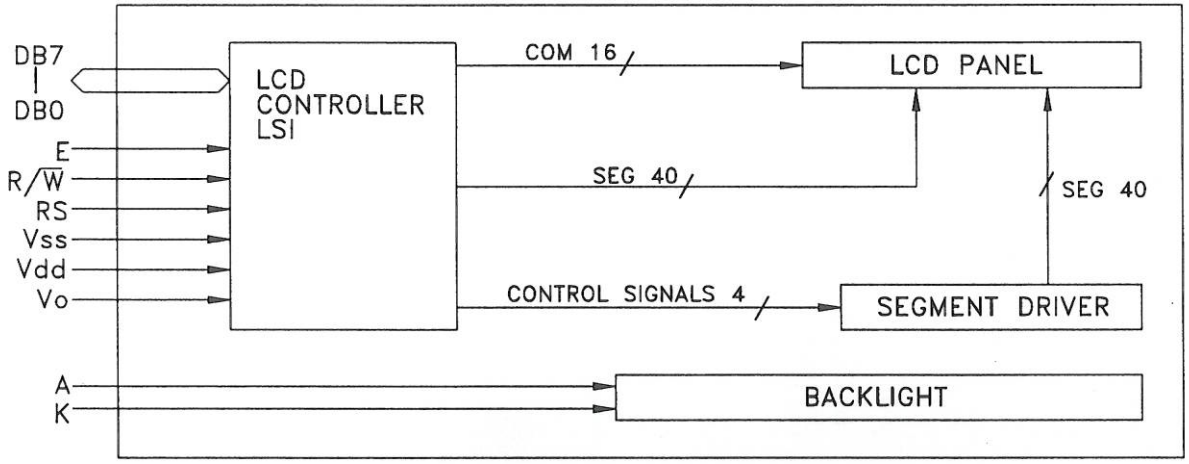
NO	Item	Specification	Judge	Level
1	Part Number	Inconsistent with the P/N on the flow chart of production	N.G.	Major
2	Quantity	Inconsistent Q'TY with the flow chart of production	N.G.	Major
3	Electronic characteristics A=(L + W) ÷ 2	Display short	N.G.	Major
		Missing line	N.G.	Major
		Dot missing A > 1/2 Dot size	N.G.	Major
		No function	N.G.	Major
		Out put data error	N.G.	Major
4	Appearance A=(L + W) ÷ 2 Dirty particle (Include scratch 、bubble)	Material difference with flow chart	N.G.	Major
		LCD Assembled in opposite direction	N.G.	Major
		Bezel assembled in opposite direction	N.G.	Major
		Shadow within LCD V./A + 1.0 mm	N.G.	Major
		Dirty particle A > 0.4 mm	N.G.	Minor
		Dirty particle length > 3.0mm And 0.01mm < Width ≦ 0.05mm (Width > 0.05mm Measure by area)	N.G.	Minor
		Without protective film	N.G.	Minor
		Conductive rubber over bezel	N.G.	Minor
5	PCB Appearance A=(L + W) ÷ 2	Burned PCB	N.G.	Major
		Green paint stripped & visible circuit A > 1.0mm (Finish coat not counted in)	N.G.	Minor
		A particle across the circuit	N.G	Minor
		Circuit split > 1/2 Circuit width	N.G	Minor
		Any circuit risen	N.G	Minor
		0.2mm < Tin ball area A ≦ 0.4mm And Q'TY > 4 Pieces	N.G	Minor
		Tin ball area A > 0.4mm	N.G	Minor

NO	Item	Specification	Judge	Level
6	Molding appearance A=(L + W)÷2	Too soft : Shape by touch changed	N.G.	Major
		Insufficient epoxy : IC circuit or IC pad visible	N.G.	Minor
		Excessive epoxy : Diameter >20mm Or High>2.5mm	N.G.	Minor
		Pin hole through to IC and A>0.2mm	N.G.	Minor
7	Bezel appearance A=(L + W)÷2	Angle between frame and TAB>45° +10°	N.G.	Minor
		Electroplate strip A >1.0mm (Top view only)	N.G.	Minor
		Rust (Top view only)	N.G.	Minor
		Crack	N.G.	Minor
8	Backlight electric characteristics A=(L + W)÷2	Error backlight color	N.G.	Major
		No function	N.G.	Major
		Any LED dot no function	N.G.	Major
		PIN soldering without tin A>1/2 solder pad	N.G.	Minor
		Solder PIN high>1.5mm	N.G.	Minor
9	LCD Appearance A=(L + W)÷2	Polarize rise over V/A	N.G.	Minor
		Rainbow A>1/3 bezel V/A	N.G.	Minor
10	Assembly parts A=(L + W)÷2	Components mark unclearly	N.G.	Minor
		Components' distance more than 0.7mm firm the PCB	N.G.	Minor
		Error position not in center D>1/2W  	N.G.	Minor
		Non- solder area>Twice solder area	N.G.	Minor
		Flux area A>1/3 solder area	N.G.	Minor
		Component broken	N.G.	Minor

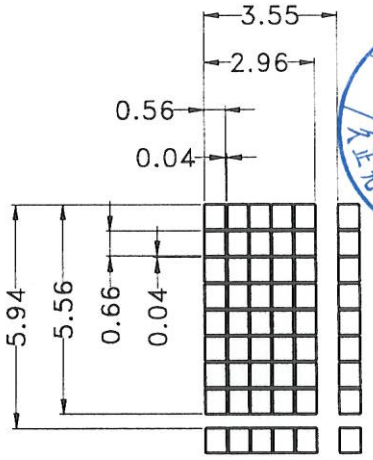




PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A
16	K



The tolerance unless classified ±0.3mm



SCALE:5/1

圖面發行 88.9.06-4 開發部 (正崎電股份有限公司)

POWERTIP TECHNOLOGY

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APPROVED 何文彥	CHECKER 開發 88.9.6 羅慶卿
	DRAWN 開發 88.9.6 羅慶卿

9/6-99