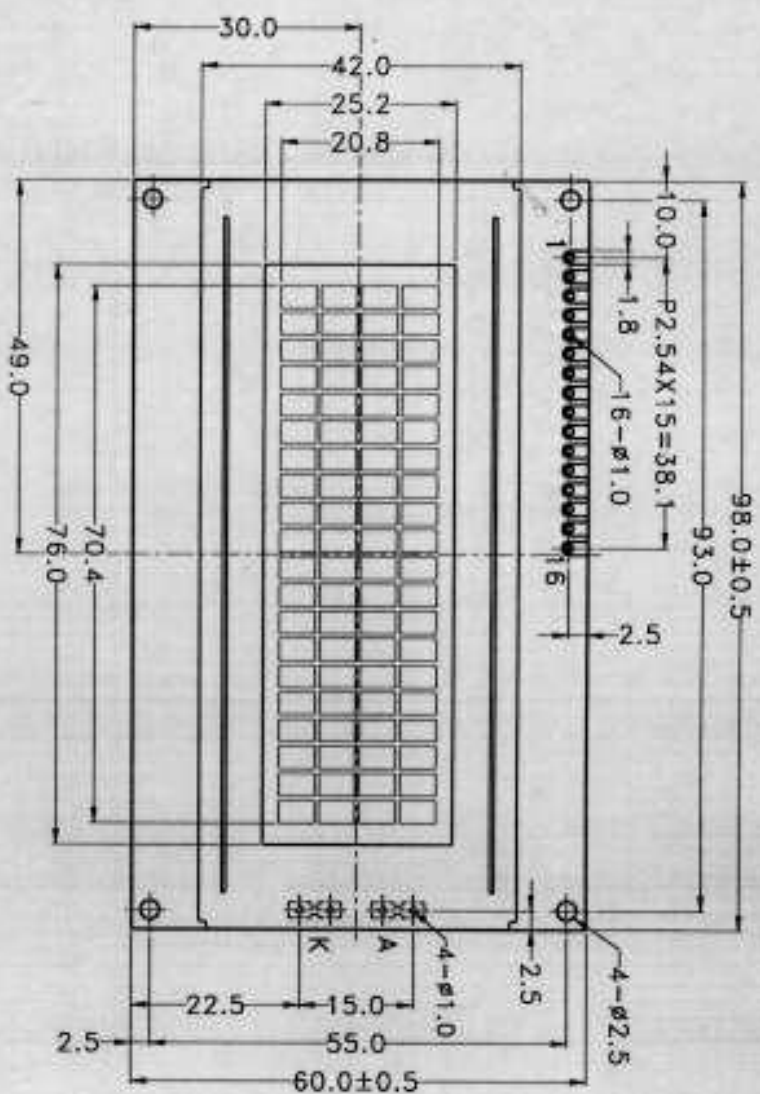
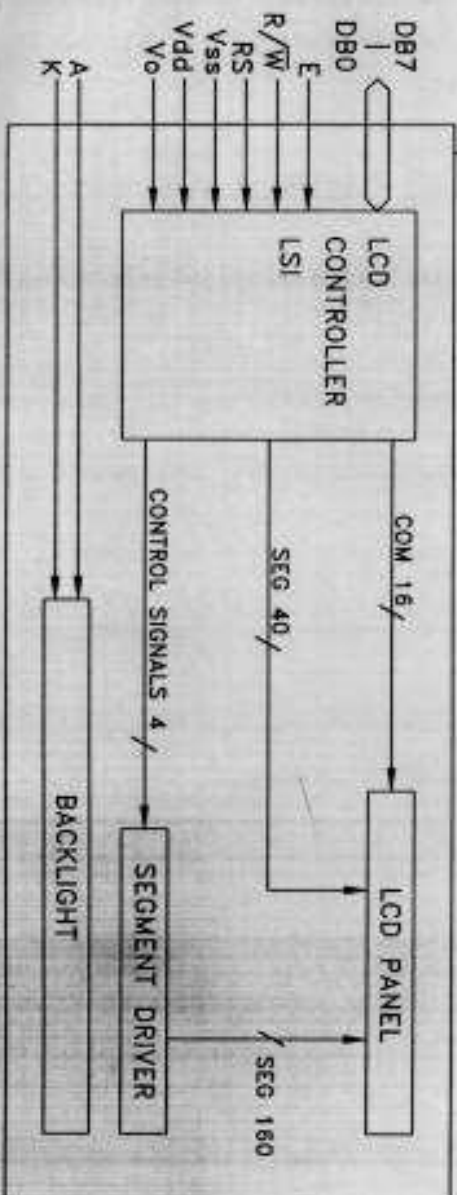
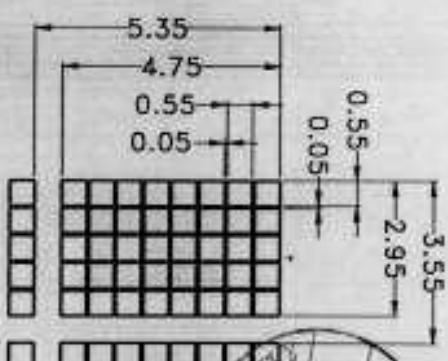


PIN NO.	SIGNAL
1	Vss
2	Vdd
3	Vo
4	RS
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A
16	K



The tolerance unless classified $\pm 0.3\text{mm}$



SCALE: 6/1

圖面發行 06318-4		POWER TIP TECHNOLOGY	
SCALE:	1/1	MODEL NAME	PC 2004BRS-AEA-E
UNIT:	mm	TITLE	COUNTER DRAWING
EDI: PAGE:	DRAWN NO.	CHECKER	PC-95011-165
0	1/1	APPROVED	

■ Features

Item		Specification			
Numbers of Characters		20 Characters/Line * 04 Line (5 * 8 dots per character)			
LCD Type		☐ TN		☒ STN	
				☐ FSTN	
		☒ Positive		☐ Negative	
Display Mode	Optical	☐ Reflective			
		☒ Transflective			
		☐ Transmissive			
	Color	☒ Gray	☐ Y/G	☐ Blue	☐ White
Viewing direction		☐ 6H ☒ 12H			
Input data		Parallel			
Backlight	Type	☐ Without Backlight			
		☒ EL B/L	☐ LED B/L	☐ CCFL B/L	
	Color	☐ Green		☐ Yellow Green	
		☐ Orange		☒ Blue Green	
		☐ Amber		☐ White	
		☐ Red			

■. Maximum Rating

Item	Symbol	Min.	Max.	Unit
Power Supply voltage	V_{DD}	-0.3	7.0	V
LCD drive Supply voltage	V_o	$V_{DD}-13.5$	$V_{DD}+0.3$	V
Input voltage	V_{IN}	-0.3	$V_{DD}+0.3$	V
Operating temperature	T_{OPR}	☑ $0^{\circ}\text{C} \sim 50^{\circ}\text{C}$		(normal)
		☐ $-20^{\circ}\text{C} \sim 70^{\circ}\text{C}$		(wider)
Storage temperature	T_{STG}	☑ $-10^{\circ}\text{C} \sim 60^{\circ}\text{C}$		(normal)
		☐ $-30^{\circ}\text{C} \sim 80^{\circ}\text{C}$		(wider)
Humidity ϕ_1	H_D	—	90	%RH

“—” : No dew to be found.

■. DC Electrical Characteristics

($V_{DD} = -5\text{V} \pm 10\%$, $V_{SS} = 0\text{V}$, $T_a = 25^{\circ}\text{C}$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply voltage	V_{DD}	—	4.5	—	5.5	V
"H" input voltage	V_{IH1}	—	2.2	—	V_{DD}	V
"L" input voltage	V_{IL1}	—	-0.3	—	0.6	V
"H" output voltage	V_{OH1}	—	2.4	—	—	V
"L" output voltage	V_{OL1}	—	—	—	0.4	V

POWERTIP TECHNOLOGY CORPORATION

AC Electrical Characteristics

Read cycle

(V_{dd}=+5V±10%, V_{ss}=0V, T_a=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Pin
Enable cycle time	t _c	500	—	—	ns	E
Enable "H" level pulse width	t _w	220	—	—	ns	E
Enable rise/fall time	t _r , t _f	—	—	25	ns	E
RS, R/W setup time	t _{su}	40	—	—	ns	RS, R/W
RS, R/W address hold time	t _h	10	—	—	ns	RS, R/W
Read data output delay	t _o	60	—	120	ns	DB0~DB7
Read data hold time	t _{DH}	20	—	—	ns	DB0~DB7

Write cycle

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Pin
Enable cycle time	t _c	500	—	—	ns	E
Enable "H" level pulse width	t _w	220	—	—	ns	E
Enable rise/fall time	t _r , t _f	—	—	25	ns	E
RS, R/W setup time	t _{su1}	40	—	—	ns	RS, R/W
RS, R/W address hold time	t _{h1}	10	—	—	ns	RS, R/W
Data setup time	t _{su2}	60	—	—	ns	DB0~DB7
Write data hold time	t _{DH}	20	—	—	ns	DB0~DB7

POWERTIP TECHNOLOGY CORPORATION

Model No.

PC 2004 BRS - AEA - E

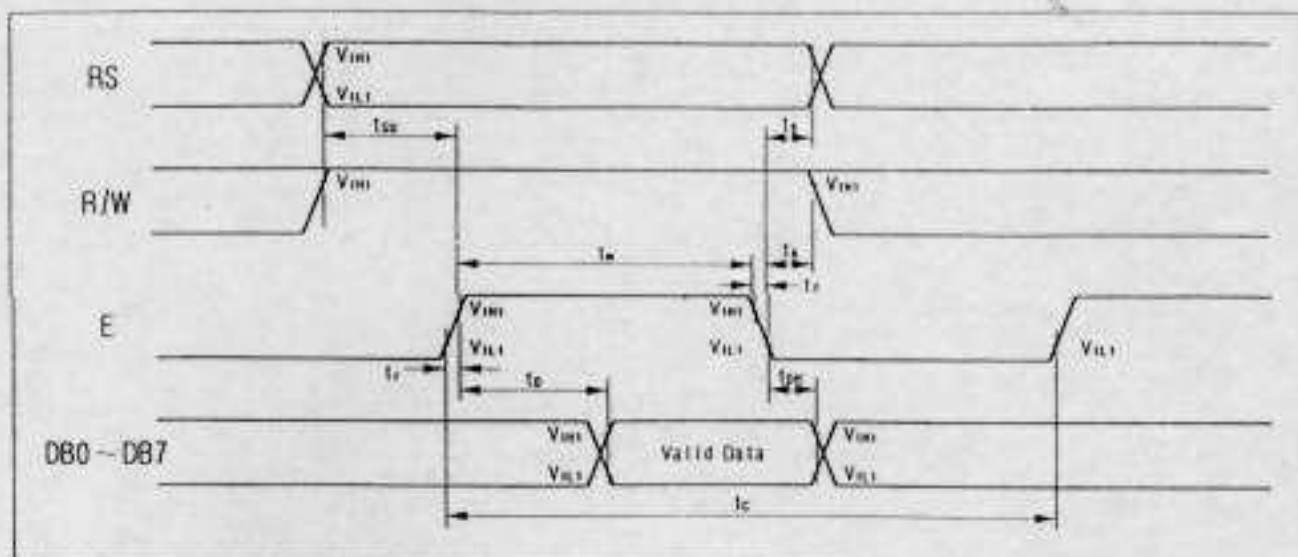
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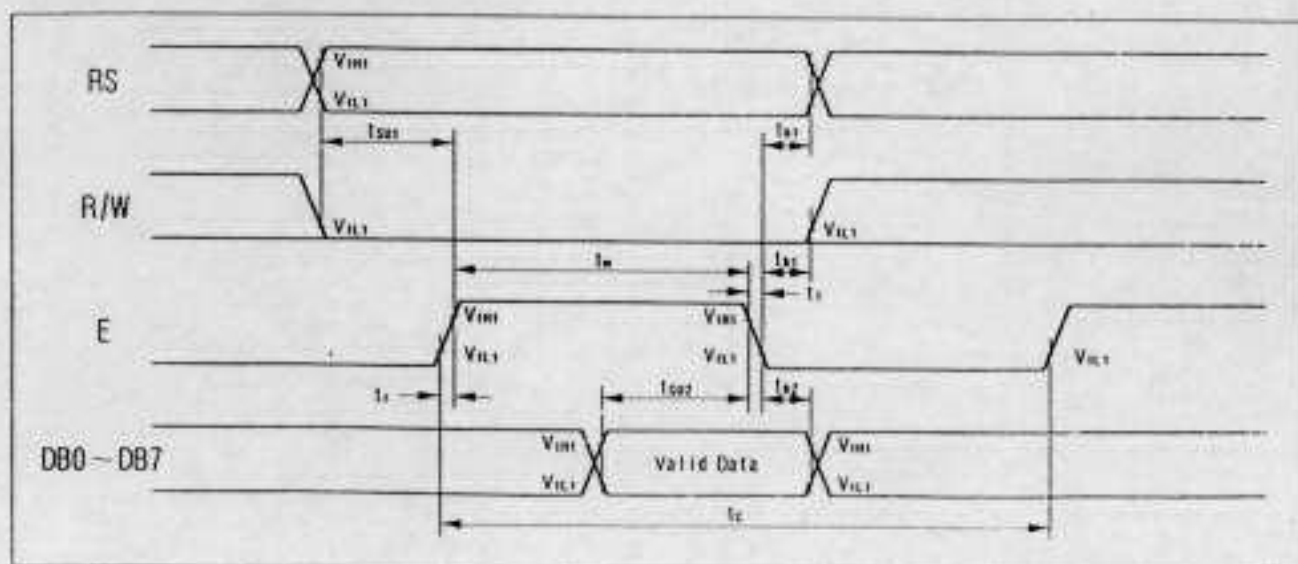
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■ Timing Characteristics

Read cycle



Write cycle



POWERTIP TECHNOLOGY CORPORATION

Display Commands

Command	RS	R/W	DB ₇	DB ₆	DB ₅	DB ₄	DB ₃	DB ₂	DB ₁	DB ₀	execution time (fosc = 250kHz)	Remark																		
DISPLAY CLEAR	L	L	L	L	L	L	L	L	L	H	1.64ms																			
RETURN HOME	L	L	L	L	L	L	L	L	H	X	1.64ms	Cursor move to first digit																		
ENTRY MODE SET	L	L	L	L	L	L	L	H	UD	SH	40 μ s	*UD: set cursor move direction <table><tr><td>UD</td><td>H</td><td>Increase</td></tr><tr><td>UD</td><td>L</td><td>Decrease</td></tr></table> *SH: Specifies shift of display <table><tr><td>SH</td><td>H</td><td>display is shifted</td></tr><tr><td>SH</td><td>L</td><td>display is not shifted</td></tr></table>	UD	H	Increase	UD	L	Decrease	SH	H	display is shifted	SH	L	display is not shifted						
UD	H	Increase																												
UD	L	Decrease																												
SH	H	display is shifted																												
SH	L	display is not shifted																												
DISPLAY ON/OFF	L	L	L	L	L	L	H	D	C	B	40 μ s	*Display <table><tr><td>D</td><td>H</td><td>Display on</td></tr><tr><td>D</td><td>L</td><td>Display off</td></tr></table> *Cursor <table><tr><td>C</td><td>H</td><td>Cursor on</td></tr><tr><td>C</td><td>L</td><td>Cursor off</td></tr></table> *Blinking <table><tr><td>B</td><td>H</td><td>Blinking on</td></tr><tr><td>B</td><td>L</td><td>Blinking off</td></tr></table>	D	H	Display on	D	L	Display off	C	H	Cursor on	C	L	Cursor off	B	H	Blinking on	B	L	Blinking off
D	H	Display on																												
D	L	Display off																												
C	H	Cursor on																												
C	L	Cursor off																												
B	H	Blinking on																												
B	L	Blinking off																												
SHIFT	L	L	L	L	L	H	SC	R/L	X	X	40 μ s	<table><tr><td>SC</td><td>H</td><td>Display shift</td></tr><tr><td>SC</td><td>L</td><td>Cursor move</td></tr></table> <table><tr><td>R/L</td><td>H</td><td>Right shift</td></tr><tr><td>R/L</td><td>L</td><td>Left shift</td></tr></table>	SC	H	Display shift	SC	L	Cursor move	R/L	H	Right shift	R/L	L	Left shift						
SC	H	Display shift																												
SC	L	Cursor move																												
R/L	H	Right shift																												
R/L	L	Left shift																												
SET FUNCTION	L	L	L	L	H	DL	N	F	X	X	40 μ s	<table><tr><td>DL</td><td>H</td><td>8 bits interface</td></tr><tr><td>DL</td><td>L</td><td>4 bits interface</td></tr></table> <table><tr><td>N</td><td>H</td><td>2 line display</td></tr><tr><td>N</td><td>L</td><td>1 line display</td></tr></table> <table><tr><td>F</td><td>H</td><td>5x10 dots</td></tr><tr><td>F</td><td>L</td><td>5x7 dots</td></tr></table>	DL	H	8 bits interface	DL	L	4 bits interface	N	H	2 line display	N	L	1 line display	F	H	5x10 dots	F	L	5x7 dots
DL	H	8 bits interface																												
DL	L	4 bits interface																												
N	H	2 line display																												
N	L	1 line display																												
F	H	5x10 dots																												
F	L	5x7 dots																												
SET CG RAM ADDRESS	L	L	L	H	CG RAM address (corresponds to cursor address)						40 μ s	CG RAM Data is sent and received after this setting																		
SET DD RAM ADDRESS	L	L	H	DD RAM address						40 μ s	DD RAM Data is sent and received after this setting																			
READ BUSY FLAG & ADDRESS	L	H	BF	Address Counter used for both DD & CG RAM address						0 μ s	<table><tr><td>BF</td><td>H</td><td>Busy</td></tr><tr><td>BF</td><td>L</td><td>Ready</td></tr></table> - Reads BF indication internal operating is being performed. - reads address counter contents	BF	H	Busy	BF	L	Ready													
BF	H	Busy																												
BF	L	Ready																												
WRITE DATA	H	L	Write Data						45 μ s	Write data into DD or CG RAM																				
READ DATA	H	H	Read Data						45 μ s	Read data from DD or CGRAM																				

X: Don't care

POWERTIP TECHNOLOGY CORPORATION

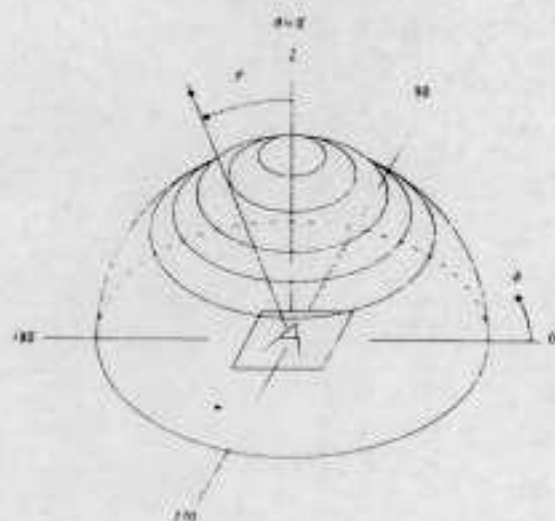
■. Optical Characteristic STN Type

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
View angle	$\phi 2-\phi 1$	$K=2.0$	60	—	—	deg.
Contrast	K	$\phi=10^\circ \theta=0^\circ$	5	—	—	—
Response time (Rise)	t_r	$\phi=10^\circ \theta=0^\circ$	—	150	250	ms
Response time (Fall)	t_f	$\phi=10^\circ \theta=0^\circ$	—	200	300	ms

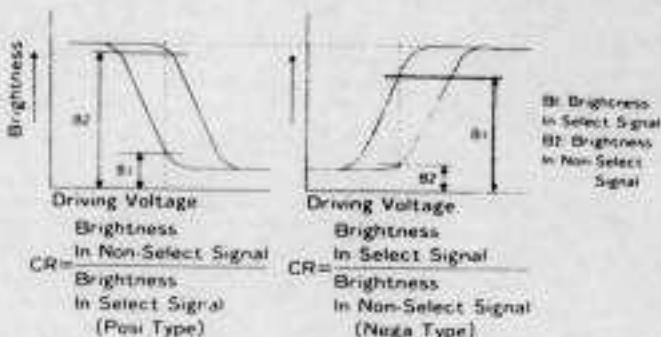
TN Type

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
View angle	$\phi 2-\phi 1$	$K=2.0$	—	40	—	deg.
Contrast	K	$\phi=10^\circ \theta=0^\circ$	—	5	—	—
Response time (Rise)	t_r	$\phi=10^\circ \theta=0^\circ$	—	80	120	ms
Response time (Fall)	t_f	$\phi=10^\circ \theta=0^\circ$	—	60	90	ms

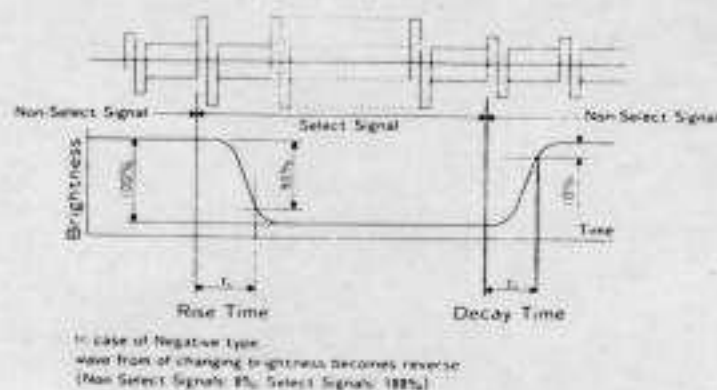
● Definition of Viewing Angle θ and ϕ



● Definition of Contrast Ratio (CR)



● Definition of Optical Response Time



POWERTIP TECHNOLOGY CORPORATION

Model No. PC 2004 BRS - AEA - E

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PAGE

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EL

■. Backlight Characteristic

1. Maximum ratings

Item	Symbol	Maximum	Unit
Supply voltage	Vmax	170	Vrms
Supply frequency	Fmax	1000	Hz
Operating temperature	Topr	-35~+50	°C
Operating humidity	Hopr	90	%RH
Storage temperature	Tstg	-40~+60	°C
Storage humidity	Hstg	70	%RH

2. Using specification

Item	Specification	Unit
Operating voltage	110	Vrms
Frequency	400	Hz

3. Electrical characteristics

Item	Condition	Unit	Min	Typ	Max
Initial intensity	(sine wave) Vac=110 Vrms Freq=400 Hz	cd/m ²	48	60	—
Current density		mA/cm ²	0.129		
Power density		mW/cm ²	3.17		
Color			Blue Green		

POWERTIP TECHNOLOGY CORPORATION

■ . Description of Terminals

Symbol	Function
V _{SS}	Signal ground (GND)
V _{DD}	Power supply for logic (+5V)
V _O	Operating voltage for LCD (variable)
RS	Register selection input High = Data register Low = Instruction register (for write) Busy flag address counter (for read)
R/W	R/W signal input is used to select the read/write mode High = Read mode, Low = Write mode
E	Start enable signal to read or write the data
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.
DB4~ DB7	For 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 backlight (+)
K	Power supply for LED backlight (-)

POWERTIP TECHNOLOGY CORPORATION

■ CHARACTER PATTERN (HO / EA / SO)

Upper Out Lower In		LLLL	LLHL	LJHL	LJLL	LJLH	LJHL	LJHH	HLLL	HLLH	HJHL	HJLH	HJLL	HJLH	HJHH
LLLL	CG RAM (1)														
LLHL	(2)														
LJHL	(3)														
LJHH	(4)														
LJLL	(5)														
LJLH	(6)														
LJHH	(7)														
LJHH	(8)														
HLLL	(1)														
HLLH	(2)														
HJHL	(3)														
HJLH	(4)														
HJLL	(5)														
HJLH	(6)														
HJHH	(7)														
HJHH	(8)														

Out Going Inspection Specification

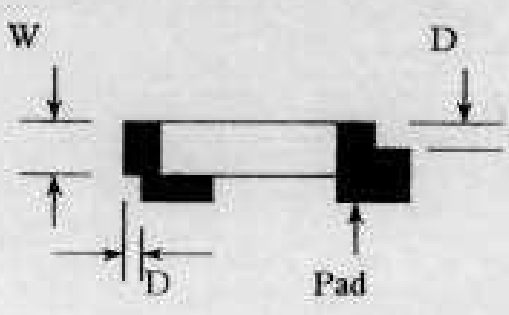
5-1. Inspection Standard : MIL-STD-105E Table Normal Inspection Single Sampling Level II

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 :

N O	Item	Specification	Judge	Level
1	Part Number	Inconsistent with the P/N on the flow chart of production	N.G.	Major
2	Quantity	Inconsistent QTY with the flow chart of production	N.G.	Major
3	Electronic characteristics $A = (L + W) \div 2$	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 $A = (L + W) \div 2$	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 (Include scratch & bubble)	Dirty particle $A > 0.4$ mm	N.G.	Minor
		Dirty particle length > 3.0 mm And $0.01\text{mm} < \text{Width} \leq 0.05\text{mm}$ (Width $> 0.05\text{mm}$ Measure by area)	N.G.	Minor
		Without protective film	N.G.	Minor
		Conductive rubber over bezel	N.G.	Minor
			N.G.	Minor
5	PCB Appearance $A = (L + W) \div 2$	Burned PCB	N.G.	Major
		Green paint stripped & visible circuit $A > 1.0$ mm (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
		$0.2\text{mm} < \text{Tin ball area } A \leq 0.4\text{mm}$ And Q'TY > 4 Pieces	N.G.	Minor
		Tin ball area $A > 0.4\text{mm}$	N.G.	Minor
			N.G.	Minor

N O	Item	Specification	Judge	Level
6	Molding appearance $A = (L + W) \div 2$	Too soft : Shape by touch changed	N.G.	Major
		Insufficient epoxy : IC circuit or IC pad visible	N.G.	Minor
		Excessive epoxy : Diameter $> 20\text{mm}$ Or High $> 2.5\text{mm}$	N.G.	Minor
		Pin hole through to IC and $A > 0.2\text{mm}$	N.G.	Minor
7	Bezel appearance $A = (L + W) \div 2$	Angle between frame and TAB $> 45^\circ + 10^\circ$	N.G.	Minor
		Electroplate strip $A > 1.0\text{mm}$ (Top view only)	N.G.	Minor
		Rust (Top view only)	N.G.	Minor
		Crack	N.G.	Minor
8	Backlight electric characteristics $A = (L + W) \div 2$	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 $> 1.5\text{mm}$	N.G.	Minor
9	LCD Appearance $A = (L + W) \div 2$	Polarize rise over V/A	N.G.	Minor
		Rainbow $A > 1/3$ bezel V/A	N.G.	Minor
10	Assembly parts $A = (L + W) \div 2$	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