POWERTIP TECH. CORP.

DISPLAY DEVICES FOR BETTER ELECTRONIC DESIGN

Specification For Approval

Customer	:	
Model Type	:	LCD Module
Sample Code	:	PC2404LRS-AJA-B-SA
Mass Production Code	:	
Edition	:	A

Customer Sign	Sales Sign	Approved By	Prepared By

CONTENTS

1. SPECIFICATIONS

1.1 Features

- 24-characters, four-lines liquid crystal display of 5*7 dot matrix + cursor
- 1/32 Duty, 1/5 bias
- STN LCD, positive, gray
- Transflective LCD
- 6 o'clock viewing angle
- 8 bits parallel data input
- Built-in LED backlight

1.2 Mechanical Specifications

- Outline dimension : 125.0mm(L)*39.0mm(W)*14.2mm max.(H)
- Viewing area : 97.0mm *27.0mm
- Active area : 88.3mm *23.4mm
- Dot size : 0.6mm * 0.65mm
- Dot pitch : 0.65mm *0.7mm
- Character Size : 3.2mm *5.55mm

1.3 Absolute Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Power supply Voltage	V_{DD}	-	-0.3	7.0	V
LCD drive Supply voltage	V_{DD}-V_O	-	V_{DD}+3.0	V_{DD}-13.5	V
Input voltage	V_{IN}	-	-0.3	V_{DD}+0.3	V
Operating temperature	T_{OPR}	-	0	50	°C
Storage temperature	T_{STG}	-	-10	60	°C
Humidity	HD	-	-	90	%RH

1.4 DC Electrical Characteristics

V_{DD}=+5V±10%,V_{SS}=0V,TA=25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply voltage	V_{DD}	-	4.5	5	5.5	V
"H" input voltage	V_{IH}	-	2.3	-	V_{DD}	V
"L" input voltage	V_{IL}	-	-	-	0.8	V
"H" output voltage	V_{OH}	-	2.4	-	-	V
"L" output voltage	V_{OL}	-	-	-	0.4	V
Supply current	I_{DD}	-	-	75.0	90	mA
LCD driving voltage	V_{OP}	V_{DD}-V_O	-	9.2	9.7	V

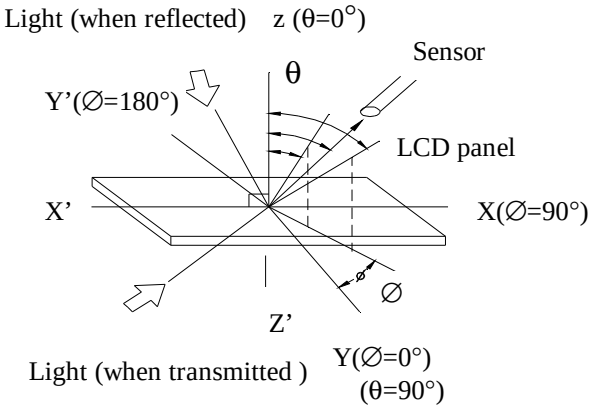
1.5 Optical Characteristics

1/32 duty, 1/6 bias, V_{OPR}=9.2V, Ta=25°C

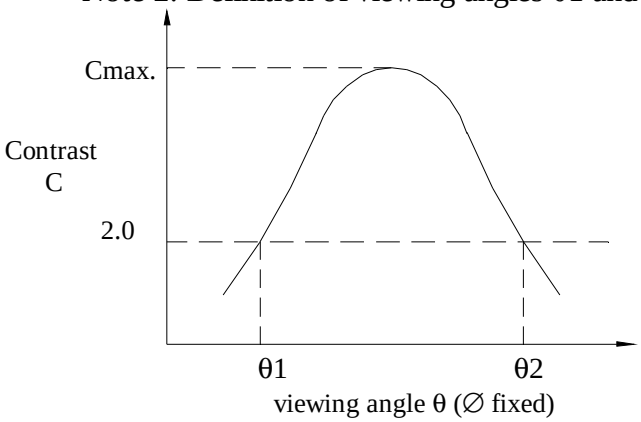
Item	Symbol	Conditions	Min.	Typ.	Max	Reference
Viewing angle	θ	C≥2.0,∅=0°	30°	-	-	Notes 1 & 2
Contrast	C	θ=5°, ∅=0°	-	3	-	Note 3
Response time(rise)	T_r	θ=5°, ∅=0°	-	130ms	200ms	Note 4
Response time(fall)	T_f	θ=5°, ∅=0°	-	250ms	400ms	Note 4

Parameter	Symbol	Temperature (°C)	Standard			Unit
			Min	Typ	Max	
Driving voltage	V_{OP}	0	9.5	10.0	10.5	V
		25	8.7	9.2	9.7	
		50	8.4	8.9	9.4	

Note 1: Definition of angles θ and ∅



Note 2: Definition of viewing angles θ1 and θ2

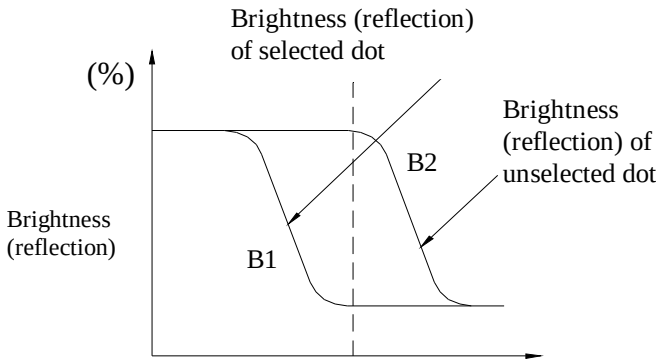


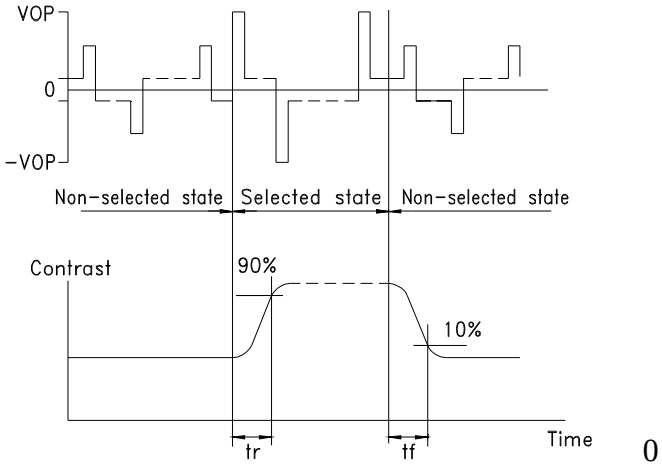
Note : Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same

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
f_{FRM} : Frame frequency
t_r : Response time (rise)
t_f : Response time (fall)

1.6 Backlight Characteristic

The LCD Module is backlight using a LED panel

•.Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Forward current	I_F	T_A=25°C	-	800	mA
Reverse voltage	V_R	T_A=25°C	-	8	V
Power dissipation	P_O	T_A=25°C	-	3.52	W
Operating Temperature	T_{OPR}	-	-20	70	°C
Storage temperature	T_{STG}	-	-40	80	°C

•.Electrical Ratings

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward voltage	V_F	I_F=320mA	-	4.0	4.4	V
Reverse current	I_R	V_R=8V	-	-	0.2	mA
Luminous intensity	I_V	I_F=320mA	116	145	-	cd/m^2
Wavelength	λp	I_F=320mA	571	-	576	nm
Color	Yellow Green					

2. MODULE STRUCTURE

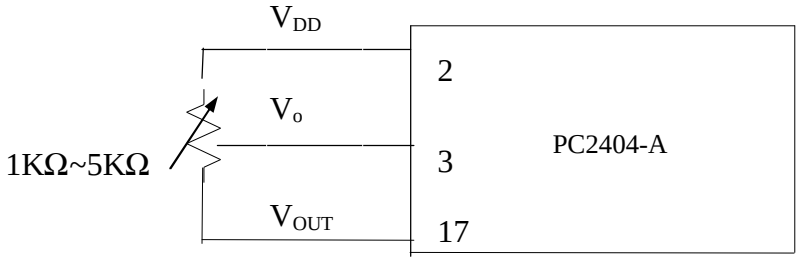
2.1 Counter Drawing

*See Appendix

2.2 Interface Pin Description

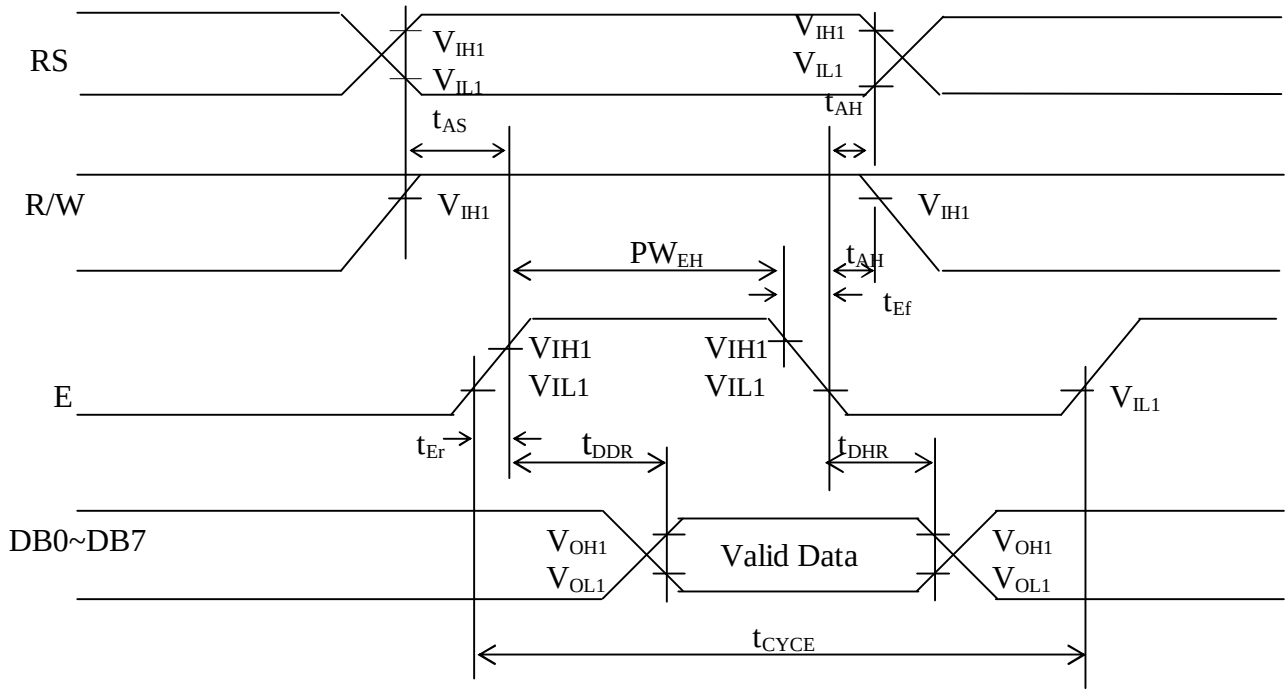
Pin No.	Symbol	Function
1	V_{SS}	Signal ground
2	V_{DD}	Power Supply (5 V)
3	V_O	Operating voltage for LCD (variable)
4	RS	Register Selection input High = Data register Low = Instruction register (for write) Busy flag address counter (for read)
5	R/W	Read/Write signal input is used to select the read/write 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	LED backlight drive voltage
16	K	LED backlight ground
17	V_{OUT}	Negative voltage output
18	NC	No connect

Contrast Adjust

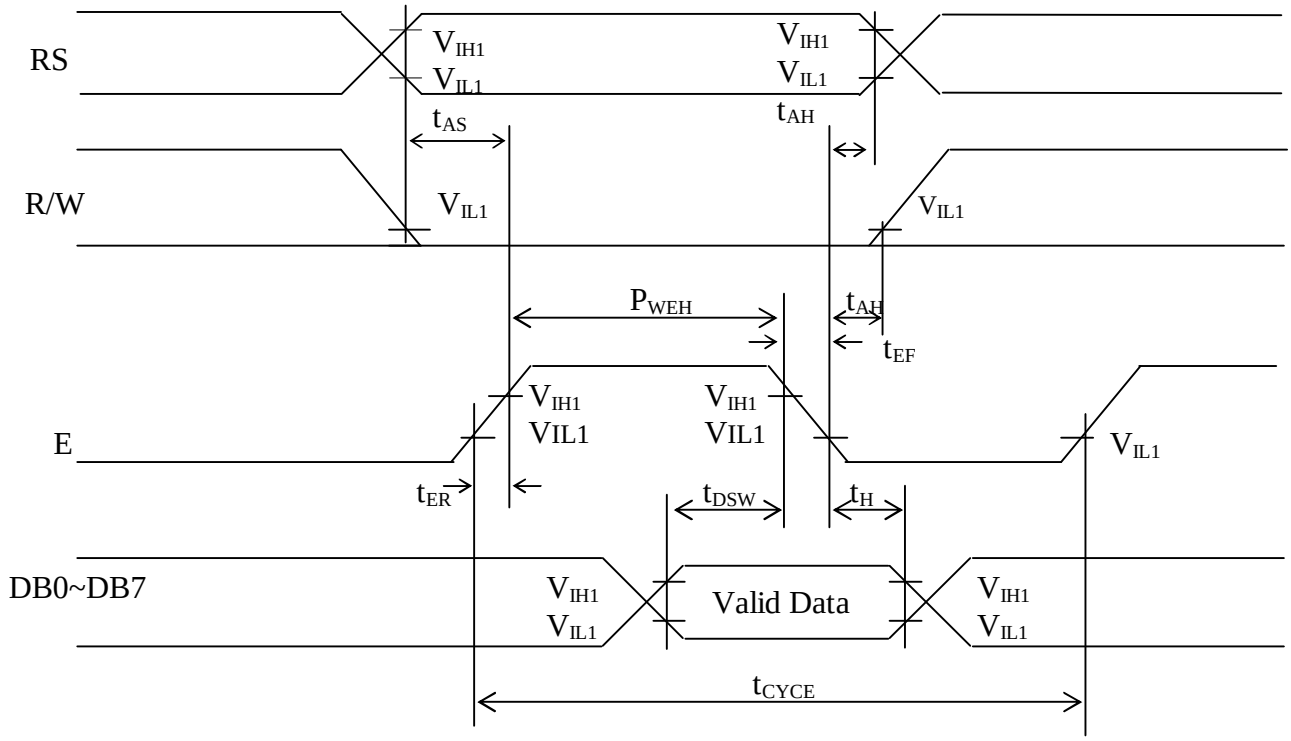


2.3 Timing Characteristics

- Read cycle



- Write cycle



• Read cycle

V_{DD}=+5V±10% ,V_{SS}=0V,Ta=25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Pin
Enable cycle time	t_{CYCE}	500	-	-	ns	E
Enable Pulse Width / “High” level	P_{WEH}	220	-	-	ns	E
Enable Rise Time, Fall time	t_{Er}, t_{Ef}	-	-	20	ns	E
RS,R/W setup time	t_{AS}	40	-	-	ns	RS,R/W
Address Hold Time	t_{AH}	10	-	-	ns	RS,R/W
Data Set up Time	t_{DSW}	60	-	-	ns	DB0~DB7
Data Hold Time	t_H	10	-	-	ns	DB0~DB7

• Write cycle

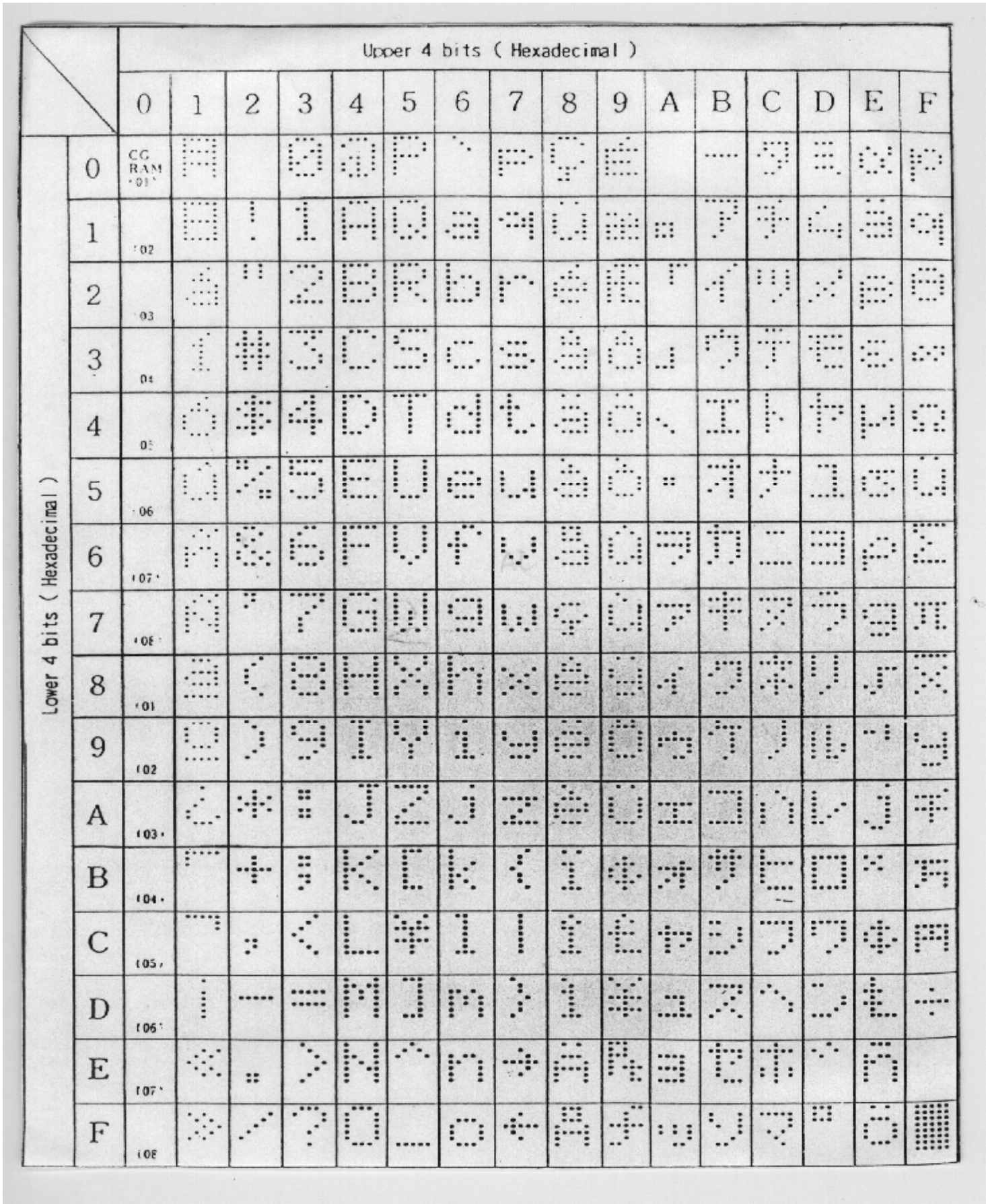
Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Pin
Enable cycle time	t_{CYCE}	500	-	-	ns	E
Enable Pulse Width / “High” level	P_{WEH}	220	-	-	ns	E
Enable Rise Time, Fall time	t_{Er}, t_{Ef}	-	-	20	ns	E
RS,R/W setup time	t_{AS}	40	-	-	ns	RS,R/W
Address Hold Time	t_{AH}	10	-	-	ns	RS,R/W
Data Set up Time	t_{DSW}	-	-	120	ns	DB0~DB7
Data Hold Time	t_H	20	-	-	ns	DB0~DB7

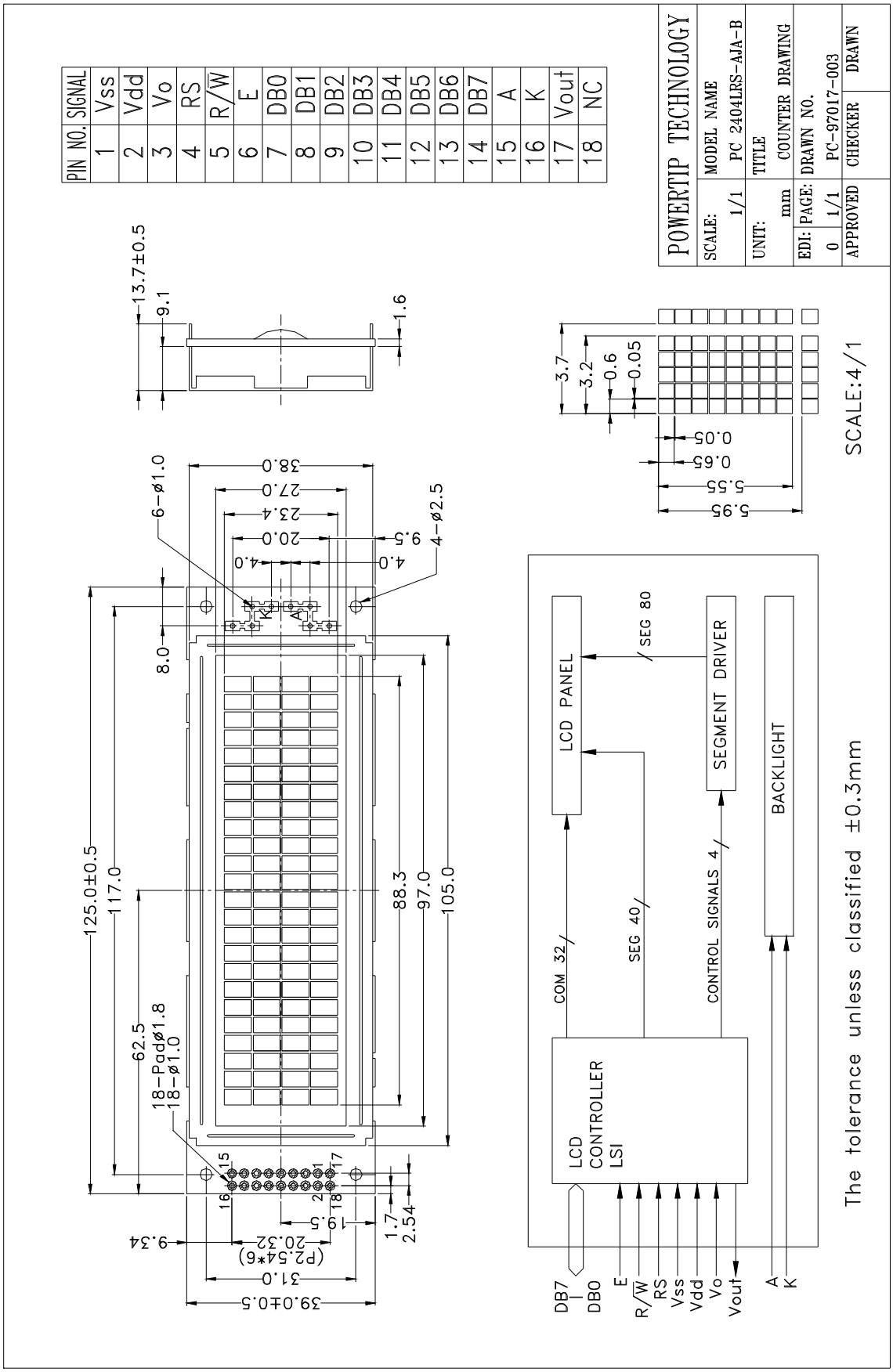
2.4 Display Command

Instructions	Instruction Code										Description	Execution Time (fosc = 330KHZ)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Display clear and sets DD RAM address 0 in AC.	30μ s
Return Home	0	0	0	0	0	0	0	0	1	×	Set DD RAM address 0 in AC and returns display being shifted to original position. DD RAM contents remain unchanged.	1.24ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies shift of display are performed in date read/write I/D=1:Increment , I/D=Decrement S=1: Accompanies display shift	30μs
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Sets of display On/Off(D) cursor On/Off (C) and blink of cursor Position character (B)	30μs
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	×	×	Moves cursor and shifts display Without changing DD RAM Contents S/C=1 : Display shift S/C=0 : Cursor shift R/L=1 : Shift to the right R/L=0 : Shift to the left	45μs
Function Set	0	0	0	0	1	DL	1	×	×	1	Set interface data length (DL), numbers of display lines(N) and display character number. Character font is fixed 5×7. DL=1 :8 bits ,DL=0 :4 bits N=1:4-line , N=0 : 2-line Please refer (g) for E0 and E1·	30μs
Set CGRAM Address	0	0	0	1	←	—	ACG	—	—	→	Sets CG RAM address. After this instruction , the date is transferred to /from CG RAM..	30μs
Set DDRAM Address	0	0	1	←	—	—	ADD	—	—	→	Sets DD RAM address. After this Instruction , the date is transferred to /from DD RAM..	30μs
Read Busy Flag and Address	0	1	BF	←	—	—	Ac	—	—	→	Reads busy flag and AC contents BF=1 : Internally operation BF=0 : Can accept instruction.	0μs
Write Data to RAM	1	0	←	—	—	write Data	—	—	—	→	Writes data into DD or CG RAMs	30μs
Read Data From RAM	1	1	←	—	—	Read Data	—	—	—	→	Reads data from DD or CG RAMs	45μs

※ "×":don't care

2.5 Character Pattern





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