POWERTIP TECH. CORP.

DISPLAY DEVICES FOR BETTER ELECTRONIC DESIGN

Specification for Approval

Customer　　　　：　_____

Model Type　　　：　LCD Module

Model Number　：　PC2402ERU-LSO-B

Edi　　　　　　　：　　0

Customer Sign	Sales Sign	Approved By	Prepared By

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1. SPECIFICATIONS

1.1 Features

- 24-characters, two-lines liquid crystal display of 5*7 dot matrix + cursor
- 1/16 Duty, 1/4 bias
- STN LCD, positive, yellow green
- Transflective LCD
- 6 o'clock viewing angle
- 8 bits parallel data input
- Built-in EL backlight

1.2 Mechanical Specifications

- Outline dimension   : 208.0mm(L)*40.0mm(W)*10.1mm max.(H)
- Viewing area   : 178.0mm   *23.0mm
- Active area   : 171.6mm   *20.64mm
- Dot size   :   1.16mm   *1.16mm
- Dot pitch   :   1.21mm   *1.21mm
- Character Size   :   6.0mm   *9.63mm

1.3 Absolute Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Power supply Voltage	V_{DD}	-	0	6.5	V
LCD drive Supply voltage	V_{DD}-V_O	-	-	13	V
Input voltage	V_{IN}	-	-0.3	V_{DD}+0.3	V
Operating temperature	T_{OPR}	-	0	50	°C
Storage temperature	T_{STG}	-	-20	60	°C
Humidity*1	HD	-	-	90	%RH

1.4 DC Electrical Characteristics

V_{DD}=+5V$\pm$10%,V_{SS}=0V,T_A=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}	-	0.8V_{DD}	-	V_{DD}	V
"L" input voltage	V_{IL}	-	0	-	0.2V_{DD}	V
"H" output voltage	V_{OH}	-	V_{DD}-0.3	-	-	V
"L" output voltage	V_{OL}	-	-	-	0.3	V
Supply current	I_{OP}	V_{DD}=5V	-	-	-	mA
LCD driving voltage	V_{LCD}	V_{DD}-V_O	-	4.3	-	V

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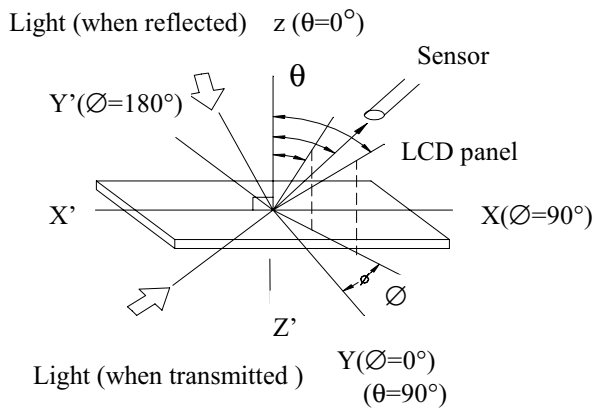DISPLAY DEVICES FOR BETTER ELECTRONIC DESIGN

1.5 Optical Characteristics

1/16 duty, 1/4 bias, Vopr=4.3V, 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°	-	2.5	-	Note 3
Response time(rise)	ton	θ=5°, ∅=0°	-	120ms	180ms	Note 4
Response time(fall)	toff	θ=5°, ∅=0°	-	250ms	400ms	Note 4

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
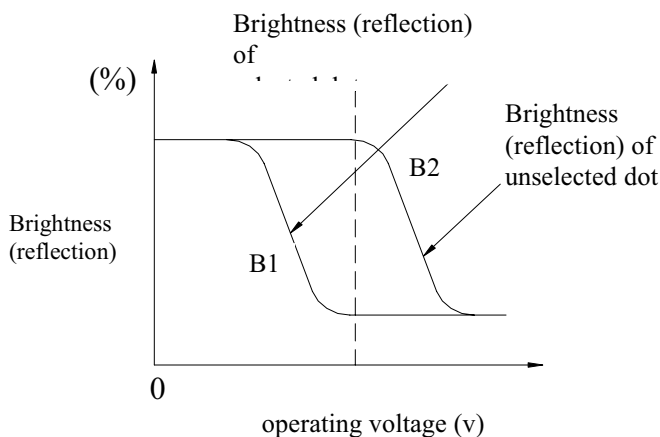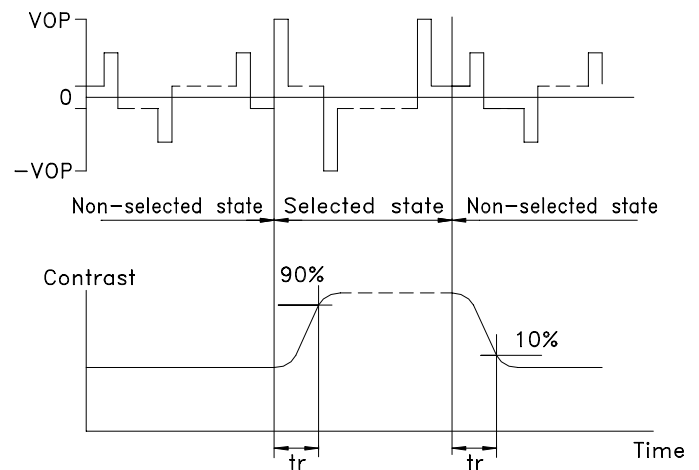
viewing angle θ (∅ fixed)
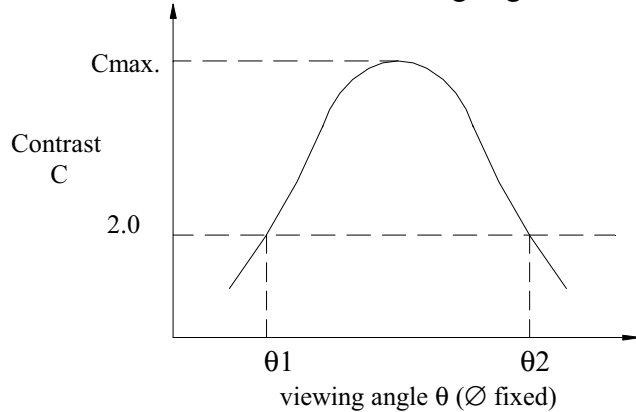
Note :   Optimum viewing angle with the
naked eye and viewing angle θ at
Cmax. Above are not always the

Note 3: Definition of contrast C

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

Brightness (reflection)
of

(%)

Brightness (reflection)
of unselected dot

B2

Brightness
(reflection)

B1

0

operating voltage (v)

Note 4: Definition of response time

VOP

0

−VOP

Non−selected state | Selected state | Non−selected state

Contrast

90%

10%

tr   tr   Time

Note: Measured with a transmissive LCD
panel which is displayed 1 cm²

Vopr : Operating voltgae   fFRM : Frame frequency
ton   : Response time (rise)   toff : Response time (fall

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1.6 Backlight Characteristic

The LCD Module is backlight using a EL panel

•.Maximum ratings

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

•.Using specification

Item	Specification	Unit
Operating voltage	110	Vrms
Frequency	400	Hz

•.Electrical Characteristics

Item		Condition	Unit	Min.	Typ	Max.
Initiate intensity		(sinewave)	cd/m^2	48	60	-
CIE color coordinate	X	VAC 110			0.2956	
	Y	Vrms			0.3803	
Current density		Freq 400	mA/cm^2		0.151	
Power density		Hz	mW/cm^2		3.61	
Color					White	

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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	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.
15	NC/VEE	NC or Vee
16	NC	No connection

Contrast Adjust
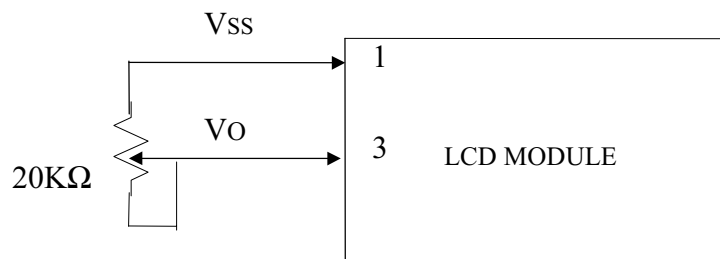
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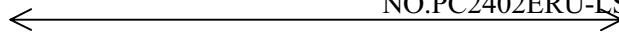DISPLAY DEVICES FOR BETTER ELECTRONIC DESIGN

2.3 Timing Characteristics

• Read cycle

• Write cycle

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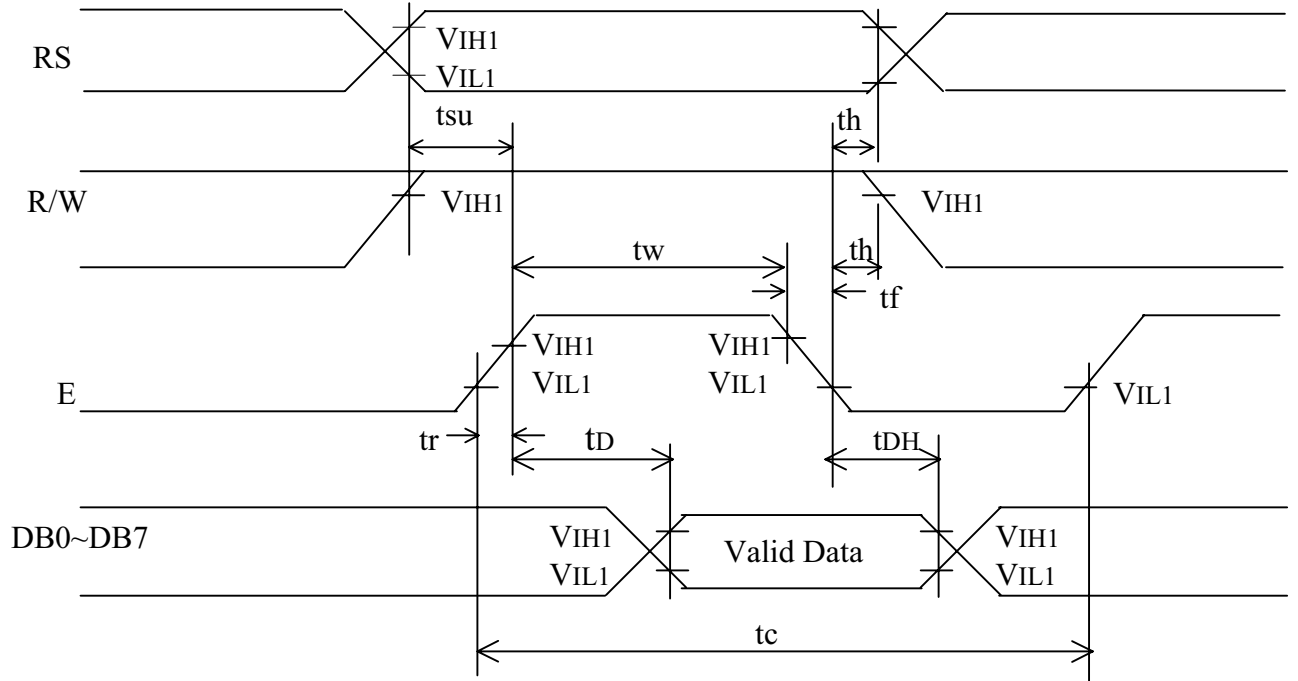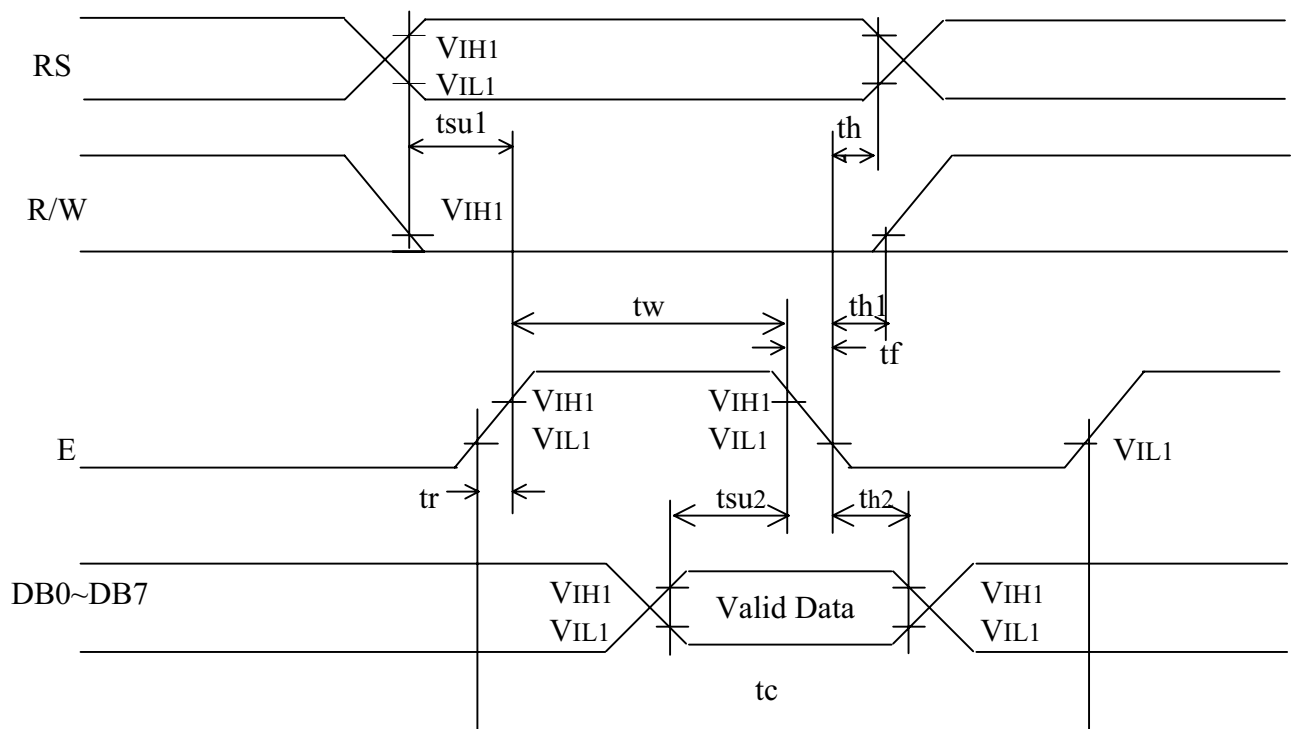
• Read cycle

$$V_{DD}=+5V\pm10\% ,V_{SS}=0V,Ta=25°C$$

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Pin
Enable cycle time	tc	500	-	-	ns	E
Enable "H" level pulse width	tw	220	-	-	ns	E
Enable rise /fall time	tr,tf	-	-	25	ns	E
RS,R/W setup time	tsu	40	-	-	ns	RS,R/W
RS,R/W address hold time	th	10	-	-	ns	RS,R/W
Read data output delay time	tD	60	-	120	ns	DB0~DB7
Read data hold time	tDH	20	-	-	ns	DB0~DB7

• Write cycle

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Pin
Enable cycle time	tc	500	-	-	ns	E
Enable "H" level pulse width	tw	220	-	-	ns	E
Enable rise /fall time	tr,tf	-	-	25	ns	E
RS,R/W setup time	tsu	40	-	-	ns	RS,R/W
RS,R/W address hold time	th	10	-	-	ns	RS,R/W
Read data output delay time	tD	60	-	-	ns	DB0~DB7
Read data hold time	tDH	10	-	-	ns	DB0~DB7

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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