POWERTIP TECH. CORP.

DISPLAY DEVICES FOR BETTER ELECTRONIC DESIGN

Specification For Approval

Customer : VECTOR

Model Type : LCD Module

Model Number : PC2002AR-BHO-J

Edit : 0

Customer Sign	Sales Sign	Approved By	Prepared By

CONTENTS

1. SPECIFICATIONS

1.1 Features

- 20-characters, 2-lines liquid crystal display of 5*7 dot matrix + cursor
- 1/16 Duty, 1/4 bias
- TN LCD, positive, gray
- Reflective LCD
- 12 o'clock viewing angle
- 8 bits parallel data input

1.2 Mechanical Specifications

- Outline dimension : 116.0mm(L)*37.0mm(W)*10.2mm max.(H)
- Viewing area : 85.0mm *18.5mm
- Active area : 73.5mm *11.5mm
- 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	VDD	-	-0.3	7.0	V
LCD drive Supply voltage	VDD-VO	-	-0.3	13.0	V
Input voltage	VIN	-	-0.3	VDD+0.3	V
Operating temperature	TOPR	-	-20	70	°C
Storage temperature	TSTG	-	-30	70	°C
Humidity*1	HD	-	-	90	%RH

1.4 DC Electrical Characteristics

VDD=2.7~4.5V, VSS=0V,TA=25°C

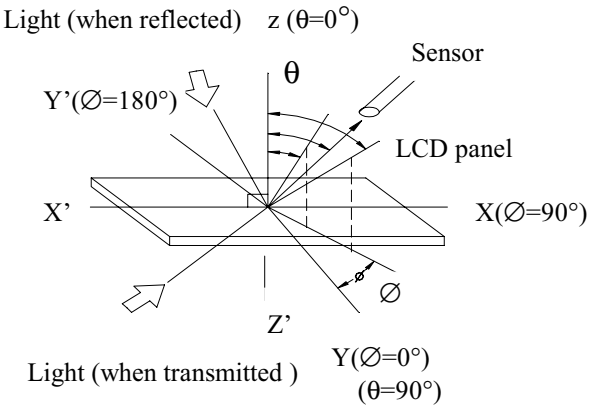
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply voltage	VDD	-	2.7	3.3	4.5	V
"H" input voltage	VIH	-	0.7VDD	-	VDD	V
"L" input voltage	VIL	-	0	-	0.55	V
"H" output voltage	VOH	-	0.75VDD	-	VDD	V
"L" output voltage	VOL	-	0	-	0.2VDD	V
Supply current	IDD	VDD=3.3V	-	0.7	-	mA
LCD driving voltage	VOP	VDD-VO	-	7.5	-	V

1.5 Optical Characteristics

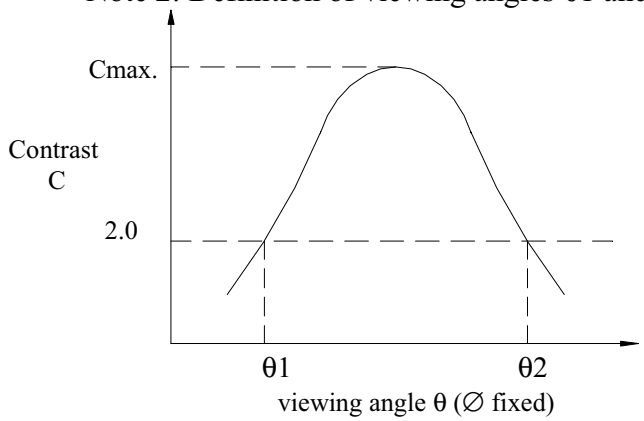
1/16 duty, 1/4 bias, Vopr=6.2V, Ta=25°C

Item	Symbol	Conditions	Min.	Typ.	Max	Reference
Viewing angle	θ	C≥2.0,∅=0°C	60°	-	80°	Notes 1 & 2
Contrast	C	θ=5°, ∅=0°	-	3	-	Note 3
Response time(rise)	tr	θ=5°, ∅=0°	-	95ms	145ms	Note 4
Response time(fall)	tf	θ=5°, ∅=0°	-	125ms	140ms	Note 4

Note 1: Definition of angles θ and ∅



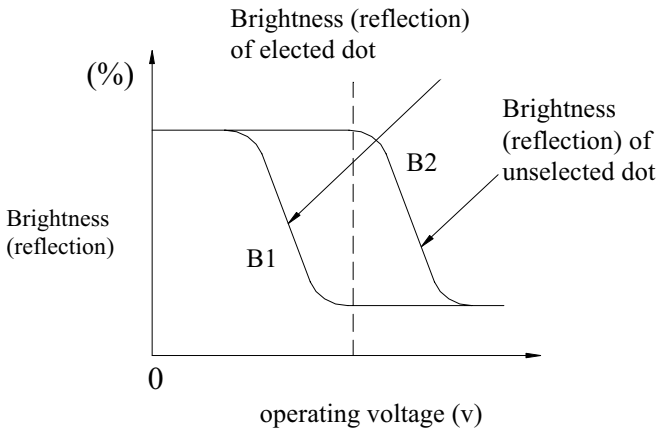
Note 2: Definition of viewing angles θ1 and θ2



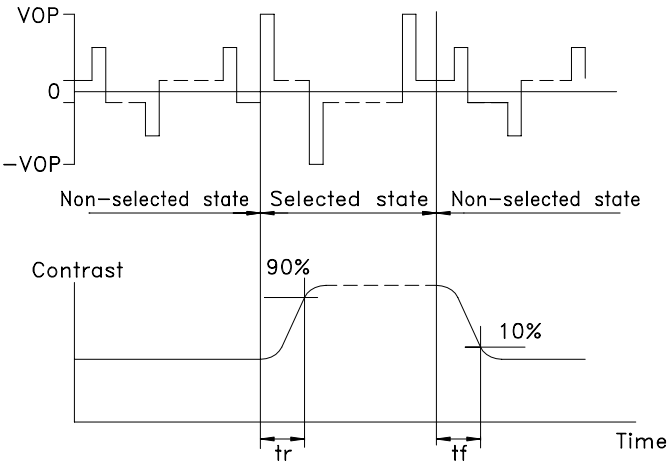
Note : Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same

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)

2. MODULE STRUCTURE

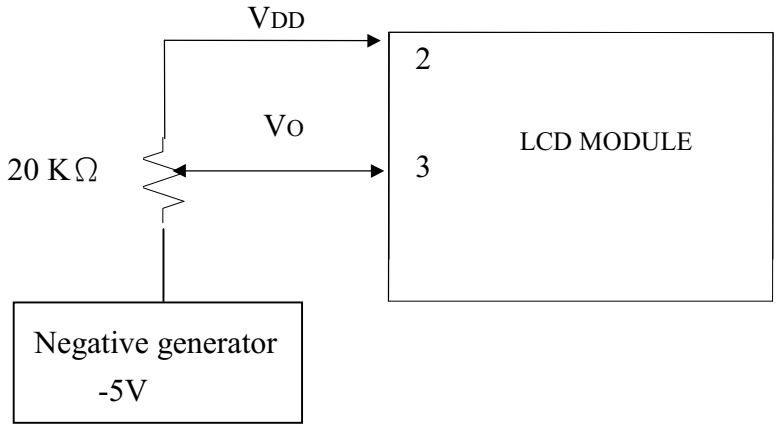
2.1 Counter Drawing

*See Appendix

2.2 Interface Pin Description

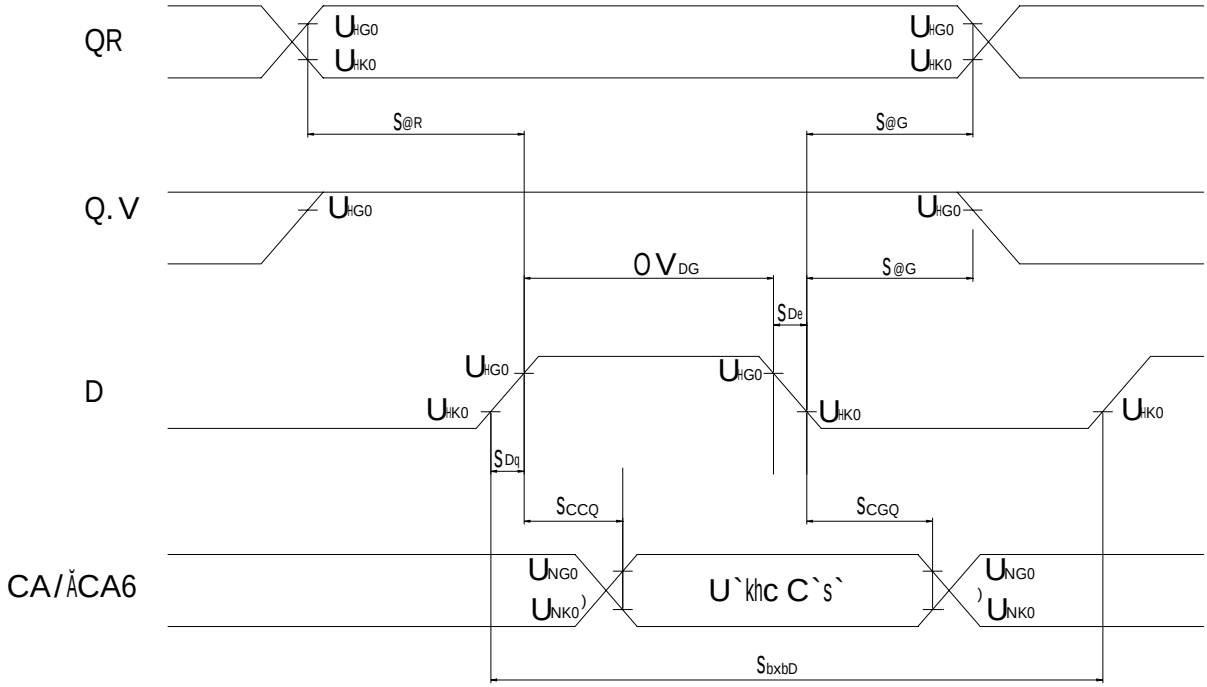
Pin No.	Symbol	Function
1	VSS	Power Supply (GND)
2	VDD	Power Supply (+3.3V)
3	VO	Contrast Adjust
4	RS	Used as register selection input
5	R/$\overline{W}$	Used as read / write selection input
6	E	Read / write enable signal
7~10	DB0 ~ DB3	Data bus line
11~14	DB4~DB7	Data bus line
15	A	Power supply for LED backlight (+)
16	K	Power supply for LED backlight (-)

Contrast Adjust

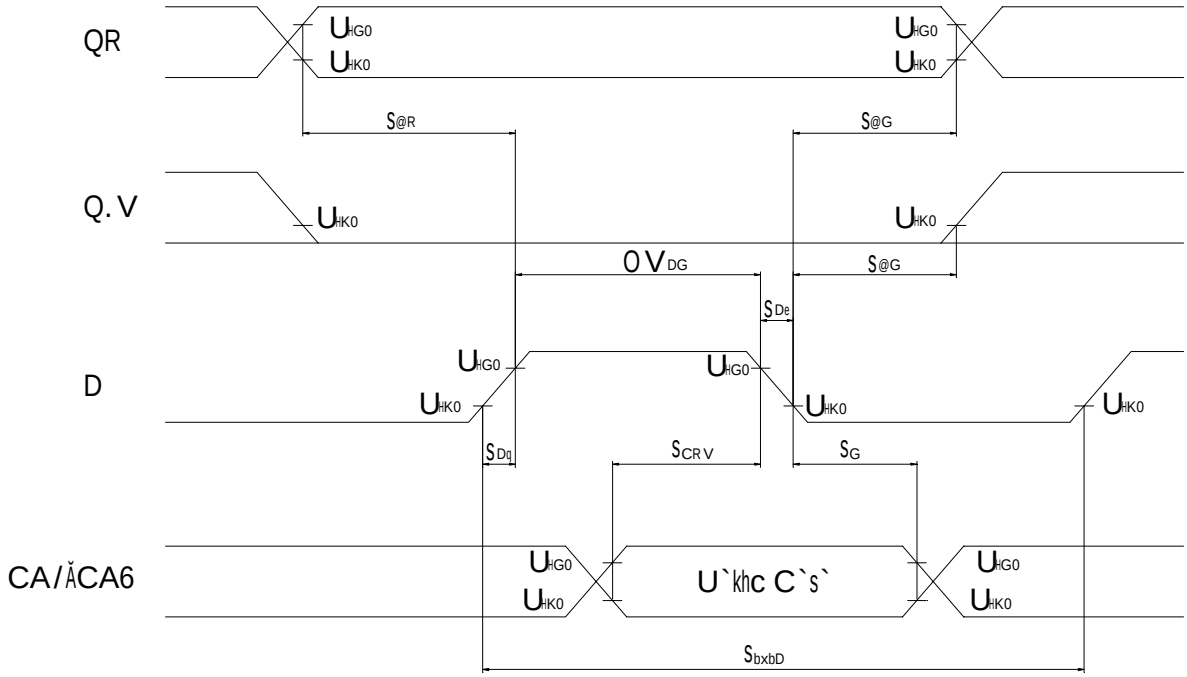


2.3 Timing Characteristics

- Read cycle



- Write cycle



• Write cycle

V_{DD}=2.7V~4.5V,Ta=-30~+85℃

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Enable cycle time	t_{CYCE}	1000	-	-	ns
Enable pulse width (high level)	PW_{EH}	450	-	25	ns
Enable rise/fall time	t_{ER}, t_{EF}	-	-	-	ns
Address set-up time (RS, R/W to E)	t_{AS}	60	-	-	ns
Address hold time	t_{AH}	20	-	-	ns
Data set-up time	t_{DSW}	195	-	-	ns
Data hold time	t_H	10	-	-	ns

• Read cycle

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Enable cycle time	t_{CYCE}	1000	-	-	ns
Enable pulse width (high level)	PW_{EH}	450	-	-	ns
Enable rise/fall time	t_{ER}, t_{EF}	-	-	25	ns
Address set-up time (RS, R/W to E)	t_{AS}	60	-	-	ns
Address hold time	t_{AH}	20	-	-	ns
Data set-up time	t_{DSW}	-	-	360	ns
Data hold time	t_H	5	-	-	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).	37μs
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	37μs

※ "× ":don't care

2.5 Character Pattern