



PRODUCT SPECIFICATION

Part Number

PG20232A-O Series

CUSTOMER	
CUSTOMER PART NUMBER	
DESCRIPTION	
APPROVED BY	
DATE	



P-TEC

MODEL NO.

PAGE

PG20232A-O series

SPEC ONLY

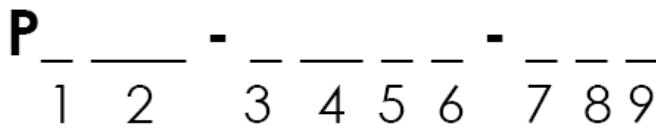
2

Table of Contents

No.	Contents	Page
1	Part number breakdown	4
2	Precautions	5
3	General Specification	5
4	Absolute Maximum Ratings	5
5	Electrical Characteristics	6
6	Optical Characteristic	6
7	Pin description	7
8	Power supply	8
9	Contour Drawing & Block Diagram	9
10	Timing Characteristics	10
11	Instruction Table	11
12	Quality Assurance	12
13	Reliability	13



1. Part number breakdown



Replace each Space (_) with the following letters and or numbers

1. P-tec LCD Type	C = Character G = Graphic COG = Chip On Glass	COF = Chip On Flex TAB = Tape Automated Bonding TFT = Thin-film Transistor
2. LCD Model	Example for Character: 2002A = 20 Characters x 2 Lines w/ Pins on Left side and 116mm x 37 x 12.7mm overall size Example for Graphic: 12864B = 128 Dots per row x 64 Dots per Column w/ Pins on lower side and 93mm x 70 x 8.8mm overall size	
3. Fluid Type	T = TN/Grey Y = STN/Yellow Green G = STN/ Grey	B = STN/ Blue F = FSTN/ White N = FSTN/ Black
4. Backlight/polorizer	NF = None/Transflective NM = None/Transmissive NR = None/Reflective EF = EL/Transflective EM = EL/Transmissive	LF = LED/Transflective LM = LED/Transmissive CF = CCFL/Transflective CM = CCFL=Transmissive
5. Backlight Color	(If no backlight provided move on to viewing angle [6.]) B = Blue/Green Y = Yellow G = Green	
6. Viewing Angle	D = 6:00 U = 12:00	R = 3:00 L = 9:00
7. Internal Number	Single Letter for internal purposes	
8. Extended Temperature	This space is blank if operating temperature is standard 0°C to 50°C An X will be visible if the LCD is Extended operating temperature	
9. Customer Specials or List of Value-added items	Usually blank unless customer requests some modifications. Can be several Letters long.	

2. Precautions in use of LCD Modules

- (1) Avoid applying excessive shocks to the module or making any alterations or modifications to it.
- (2) Don't make extra holes on the printed circuit board, modify its shape or change the components of LCD module.
- (3) Don't disassemble the LCM.
- (4) Don't operate it above the absolute maximum rating.
- (5) Don't drop, bend or twist LCM.
- (6) Soldering: only to the I/O terminals.
- (7) Storage: please storage in anti-static electricity container and clean environment.

3. General Specification

Item	Dimension	Unit
Number of Characters	202 x 32	—
Module dimension	150.0 x 45.8 x 12.0 (MAX)	mm
View area	123.0 x 24.0	mm
Active area	119.14 x 21.08	mm
Dot size	0.55 x 0.62	mm
Dot pitch	0.59 x 0.66	mm
LCD type	STN, Positive	
Duty	1/32	
View direction	6 o'clock	
Backlight Type	WHITE LED BACKLIGHT	

4. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T_{OP}	-0	—	+50	°C
Storage Temperature	T_{ST}	-10	—	+60	°C
Input Voltage	V_I	-0.3	—	VDD+0.3	V
Supply Voltage For Logic	$V_{DD}-V_{SS}$	-0.3	—	7.0	V
Supply Voltage For LCD	$V_{DD}-V_0$	Vdd-13.5	—	0	V

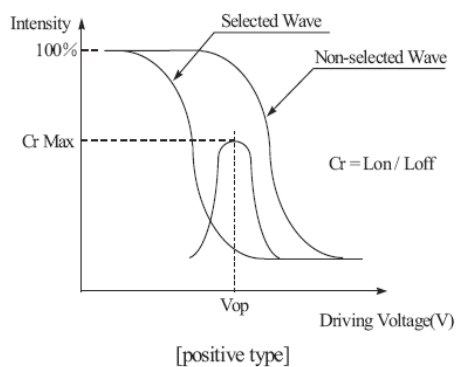
5. Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	$V_{DD}-V_{SS}$	—	4.5	5.0	5.5	V
Supply Voltage For LCD	$V_{DD}-V_0$	$T_a=25^\circ\text{C}$	-	5.0	-	V
Input High Volt.	V_{IH}	—	$0.7 V_{DD}$	—	V_{DD}	V
Input Low Volt.	V_{IL}	—	V_{SS}	—	$0.3 V_{DD}$	V
Supply Current	I_{DD}	$V_{DD}=5\text{V}$	-	0.8	1.2	mA
Supply Voltage of White backlight	V_{LED}	Forward current =45 mA Number of LED dice 3	2.9	3.1	3.3	V

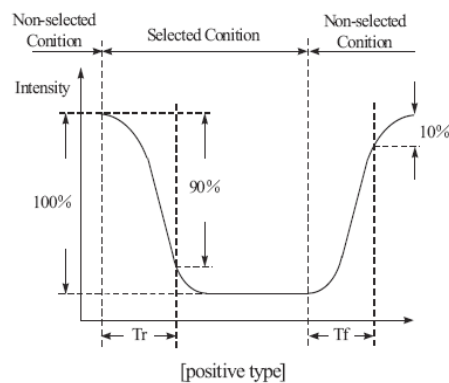
6. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	$(V)\theta$	$CR \geq 2$	20	—	35	deg
	$(H)\varphi$	$CR \geq 2$	-30	—	30	deg
Contrast Ratio	CR	—	—	3	—	—
Response Time	T rise	—	—	—	250	ms
	T fall	—	—	—	250	ms

Definition of Operation Voltage (V_{op})

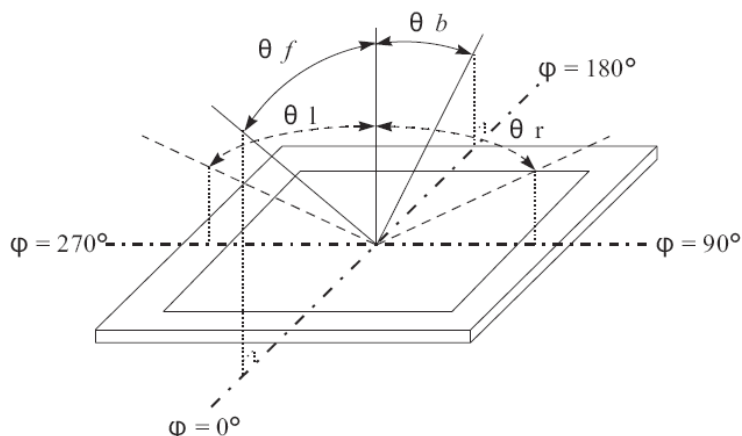


Definition of Response Time (T_r , T_f)



Conditions :

Operating Voltage : V_{op} Viewing Angle(θ , φ) : 0° , 0°
 Frame Frequency : 64 HZ Driving Waveform : 1/N duty , 1/a bias

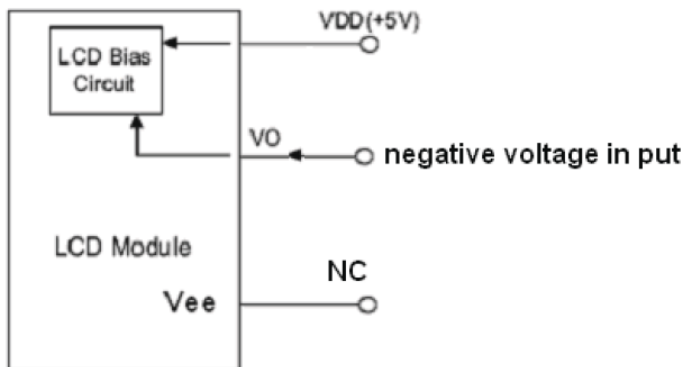
Definition of viewing angle($CR \geq 2$)


7.Interface Pin Function

Pin No.	Symbol	Level	Description
1	V _{ss}	0V	GND
2	V _{DD}	5.0V	Power supply for LOGIC
3	V ₀		Operating voltage for LCD
4	A0	H/L	Register Select
5	R/W	H/L	Read/Write
6	CS1	H/L	Chip Select Signal
7~14	DB0~DB7	H/L	Data Bus
15	V _{ee}		Negative Voltage for LCD
16	/RES	H/L	Set Chip Initialized
17	A	3.1V	Anode of Backlight
18	K	0V	Cathode of Backlight
19	CS2	H/L	Chip Select Signal
20	CS3	H/L	Chip Select Signal

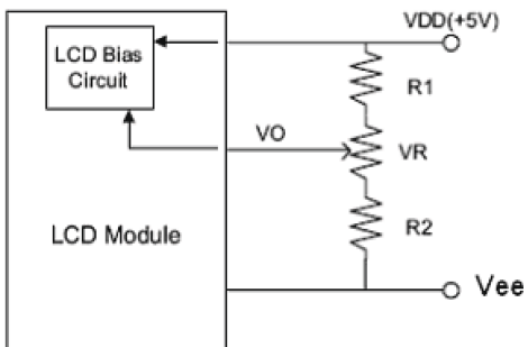
8. POWER SUPPLY

Without Negative Power on PCB



without DC-DC converter

With Negative Power on PCB

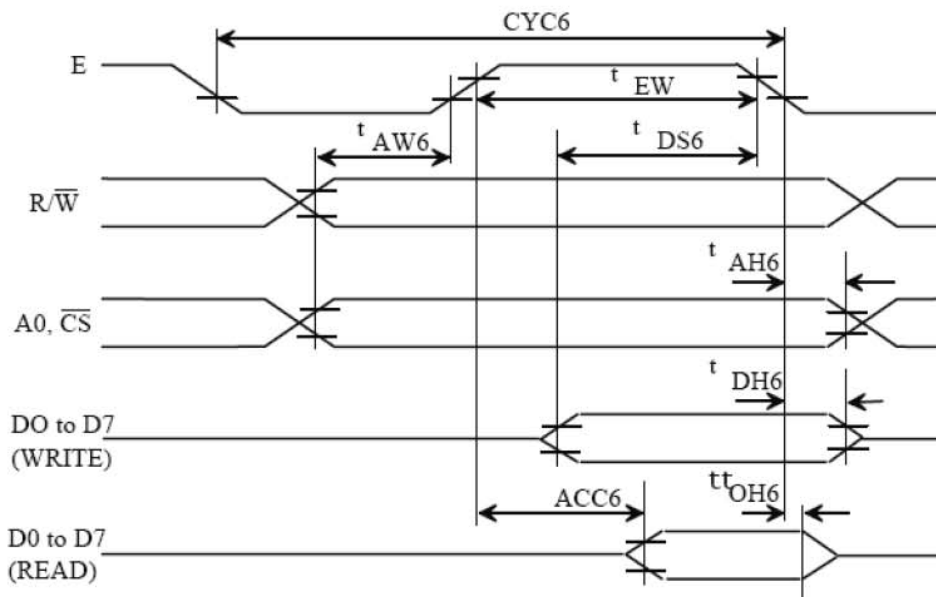


with DC-DC converter

VR:10K-20K

10. Timing Characteristics

• MPU Bus Read/Write II (68-family MPU)



Ta = -20 to 75 deg. C. Vss = -5.0V ± 10% unless stated otherwise

Parameter	Symbol	Condition	Rating		Unit	Signal
			min	max		
System cycle time	tCYC6		1,000	--	ns	A0, \overline{CS} , $\overline{R/W}$
Address setup time	tAW6		20	--	ns	
Address hold time	tAH6		10	--	ns	
Data setup time	tDS6		80	--	ns	D0 to D7
Data hold time	tDH6		10	--	ns	
Output disable time	tOH6		10	60	ns	
Access time	tACC6	CL = 100pF	--	90	ns	
Enable pulsewidth	Read	tEW	100	--	ns	E
	Write		80	--	ns	

Notes : 1. tCYC6 is the cycle time of CS. E=H. not the cycle time of E.

2. Increase parameter values by 200% when Vss = -3.0V.

3. all inputs must have a rise and fall time of less than 15 ns.

11. Instruction Table

COMMANDS

Summary

Command	Code											Function
	A0	\overline{RD}	\overline{WR}	D7	D6	D5	D4	D3	D2	D1	D0	
Display On/Off	0	1	0	1	0	1	0	1	1	1	0/1	Turns display on or off. 1 : ON, 0 : OFF
Display start line	0	1	0	1	1	0	Display start address (0 to 31)				Specifies RAM line corresponding to top line of display.	
Set page address	0	1	0	1	0	1	1	1	0	Page (0 to 3)		Sets display RAM page in page address register.
Set column (segment) address	0	1	0	0	Column address (0 to 79)						Sets display RAM column address in column address register.	
Read status	0	0	1	Busy	ADC	ON/OFF	Reset	0	0	0	0	Reads the following status : BUSY 1 : Busy 0 : Ready ADC 1 : CW output 0 : CCW output ON/OFF 1 : Display off 0 : Display on RESET 1 : Being reset 0 : Normal
Write display data	1	1	0	Write data							Writes data from data bus into display RAM.	
Read display data	1	0	1	Read data							Reads data from display RAM onto data bus.	
Select ADC	0	1	0	1	0	1	0	0	0	0	0/1	0 : CW output, 1 : CCW output
Static drive ON/OFF	0	1	0	1	0	1	0	0	1	0	0/1	Selects static driving operation. 1 : Static drive, 0 : Normal driving
Select duty	0	1	0	1	0	1	0	1	0	0	0/1	Selects LCD duty cycle 1 : 1/32, 0 : 1/16
Read-Modify-Write	0	1	0	1	1	1	0	0	0	0	0	Read-modify-write ON
End	0	1	0	1	1	1	0	1	1	1	0	Read-modify-write OFF
Reset	0	1	0	1	1	1	0	0	0	1	0	Software reset

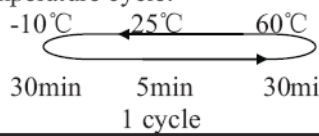
12. Quality Assurance

Screen Cosmetic Criteria

Item	Defect	Judgment Criterion	Partition
1	Spots	A)Clear <u>Size: d mm</u> <u>Acceptable Qty in active area</u> $d \leq 0.1$ Disregard $0.1 < d \leq 0.2$ 6 $0.2 < d \leq 0.3$ 2 $0.3 < d$ 0 Note: Including pin holes and defective dots which must be within one pixel size. B)Unclear <u>Size: d mm</u> <u>Acceptable Qty in active area</u> $d \leq 0.2$ Disregard $0.2 < d \leq 0.5$ 6 $0.5 < d \leq 0.7$ 2 $0.7 < d$ 0	Minor
2	Bubbles in Polarizer	<u>Size: d mm</u> <u>Acceptable Qty in active area</u> $d \leq 0.3$ Disregard $0.3 < d \leq 1.0$ 3 $1.0 < d \leq 1.5$ 1 $1.5 < d$ 0	Minor
3	Scratch	In accordance with spots cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable.	Minor
4	Allowable Density	Above defects should be separated more than 30mm each other.	Minor
5	Coloration	Not to be noticeable coloration in the viewing area of the LCD panels. Back-light type should be judged with back-light on state only.	Minor

13. Reliability

Content of Reliability Test

Environmental Test			
Test Item	Content of Test	Test Condition	Applicable Standard
High Temperature storage	Endurance test applying the high storage temperature for a long time.	60°C 96hrs	—
Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-10°C 96hrs	—
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	50°C 96hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	0°C 96hrs	—
High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	60°C, 90%RH 96hrs	—
High Temperature/ Humidity Operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	50°C, 90%RH 96hrs	—
Temperature Cycle	Endurance test applying the low and high temperature cycle. 	-10°C/60°C 10 cycles	—
Mechanical Test			
Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hrs	—
Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G Half sign wave 11 msdc 3 times of each direction	—

***Supply voltage for logic system=5V. Supply voltage for LCD system =Operating voltage at 25°C