P-TEC

PRODUCT SPECIFICATION

Part Number

PG12232F-O Series

CUSTOMER	
CUSTOMER PART NUMBER	
DESCRIPTION	
APPROVED BY	
DATE	

Table of Contents

Record of Revisions

Rev.	Comments	Page	Date
1	Preliminary Specification was first issued.	All	8/8'14

1. Part number breakdown

P_ __ - _ __ _ _ - _ _ _
1 2   3 4 5 6   7 8 9

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

1. P-tec LCD Type	**C** = Character　　　　**COF** = Chip On Flex **G** = Graphic　　　　　**TAB** = Tape Automated Bonding **COG** = Chip On Glass　**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　　　　　　**B** = STN/ Blue **Y** = STN/Yellow Green　**F** = FSTN/ White **G** = STN/ Grey　　　　　**N** = FSTN/ Black
4. Backlight/polorizer	**NF** = None/Transflective　**LF**= LED/Transflective **NM**= None/Transmissive　**LM**= LED/Transmissive **NR**=None/Reflective　　　**CF**= CCFL/Transflective **EF**= EL/Transflective　　　**CM**=CCFL=Transmissive **EM**= EL/Transmissive
5. Backlight Color	(If no backlight provided move on to viewing angle [6.]) **B** = Blue/Green　　**S** = Yellow/Green **Y** = Yellow　　　　**O** = Orange **G** = Green　　　　**W** = White
6. Viewing Angle	**D** = 6:00　　　　**R** = 3:00 **U** = 12:00　　　**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 Dots	122 x 32	—
Module dimension(No Backlight)	98.0 x 60.0 x 13.0（MAX）	mm
Module dimension(With LED Backlight)	98.0 x 60.0 x 13.0（MAX）	mm
View area	76.0 x 25.2	mm
Active area	69.50 x 20.76	mm
Dot size	0.53 x 0.61	mm
Dot pitch	0.57 x 0.65	mm
LCD type	STN	
Duty	1/32	
View direction	6 o'clock or 12 o'clock	
Backlight Type	None, YELLOW-GREEN backlight	

4. Absolute Maximum Ratings

Item		Symbol	Min	Max	Unit
Input Voltage		V_I	-0.3	VDD+0.3	V
Supply Voltage For Logic		$VDD-V_{SS}$	-0.3	7.0	V
Supply Voltage For LCD		$V_{DD}-V_0$	Vdd-13.5	0	V
Standard Temperature LCM	Operating Temp.	Top	0	50	℃
	Storage Temp.	Tstr	-10	60	℃
Wide Temperature LCM	Operating Temp.	Top	-20	70	℃
	Storage Temp.	Tstr	-30	80	℃

5. Electrical Characteristics

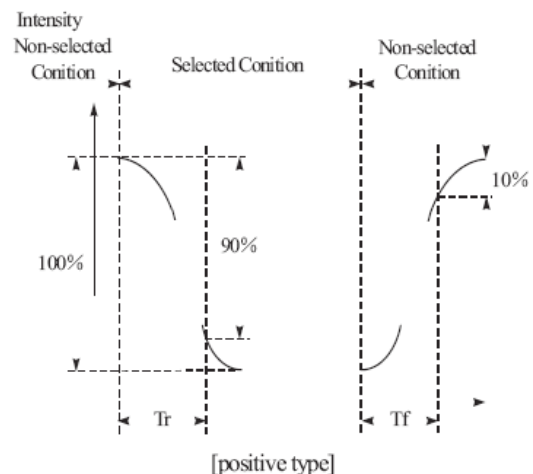| Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	$V_{DD}-V_{SS}$	—	4.5	5.0	5.5	V
Supply Voltage For LCD	$V_{DD}-V_0$	Ta=25℃	-	5.5	-	V
Input High Volt.	V_{IH}	—	$0.7\ V_{DD}$	—	V_{DD}	V
Input Low Volt.	V_{IL}	—	V_{SS}	—	$0.3\ V_{DD}$	V
Supply Current	I_{DD}	V_{DD}=5V	-	12.0	20.0	mA
Supply Voltage of Yellow-green backlight	V_{LED}	Forward current =240 mA Number of LED die 2x24= 48	3.8	4.1	4.3	V

6. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V)θ	CR≧2	-20	—	35	deg
	(H)φ	CR≧2	-30	—	30	deg
Contrast Ratio	CR	—	—	3	—	—
Response Time	T rise	—	—	—	250	ms
	T fall	—	—	—	250	ms

Definition of Operation Voltage (Vop)   **Definition of Response Time (Tr , Tf)**
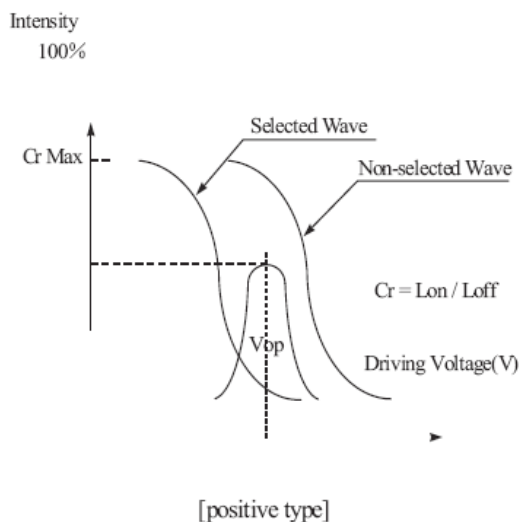
Intensity
100%

Cr Max

Selected Wave

Non-selected Wave

Cr = Lon / Loff

Vop

Driving Voltage(V)

[positive type]

Intensity
Non-selected Conition   Selected Conition   Non-selected Conition

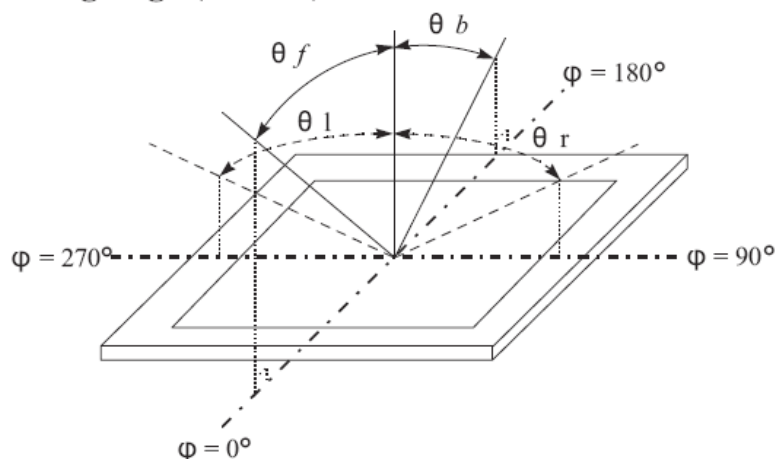100%   90%   10%

Tr   Tf

[positive type]

Conditions :

Operating Voltage : Vop   Viewing Angle(θ , φ) : 0° ， 0°

Frame Frequency : 64 HZ   Driving Waveform : 1/N duty , 1/a bias

Definition of viewing angle(CR≧2)

θ b

θ f

φ = 180°

θ l   θ r

φ = 270°   φ = 90°

φ = 0°

7. Interface Pin Function

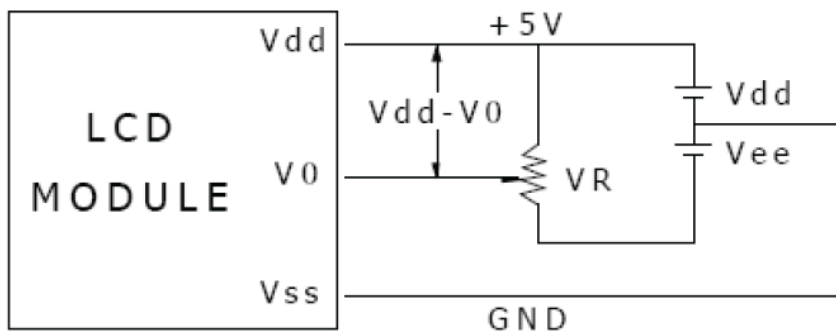| Pin No.	Symbol	Level	Description
1	V_{SS}	0V	Ground
2	V_{DD}	5.0V	Supply Voltage for logic
3	V0		Operating voltage for LCD
4	A0	H/L	Register Select
5	E1	H/L	Enable For Chip1, Active High, Left Part
6	E2	H/L	Enable For Chip2, Active High, Left Part
7	DB0	H/L	Data bit 0
8	DB1	H/L	Data bit 1
9	DB2	H/L	Data bit 2
10	DB3	H/L	Data bit 3
11	DB4	H/L	Data bit 4
12	DB5	H/L	Data bit 5
13	DB6	H/L	Data bit 6
14	DB7	H/L	Data bit 7
15	LED(+)		Anode of LED Backlight
16	LED(-)		Cathode of LED Backlight
17	RW	H/L	Read/Write
18	RST	H/L	Reset Signal

8. POWER SUPPLY

SINGLE SUPPLY VOLTAGE TYPE (for LCM with Negative Power on PCB)
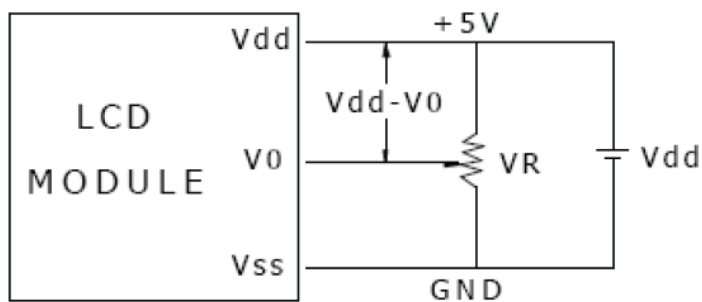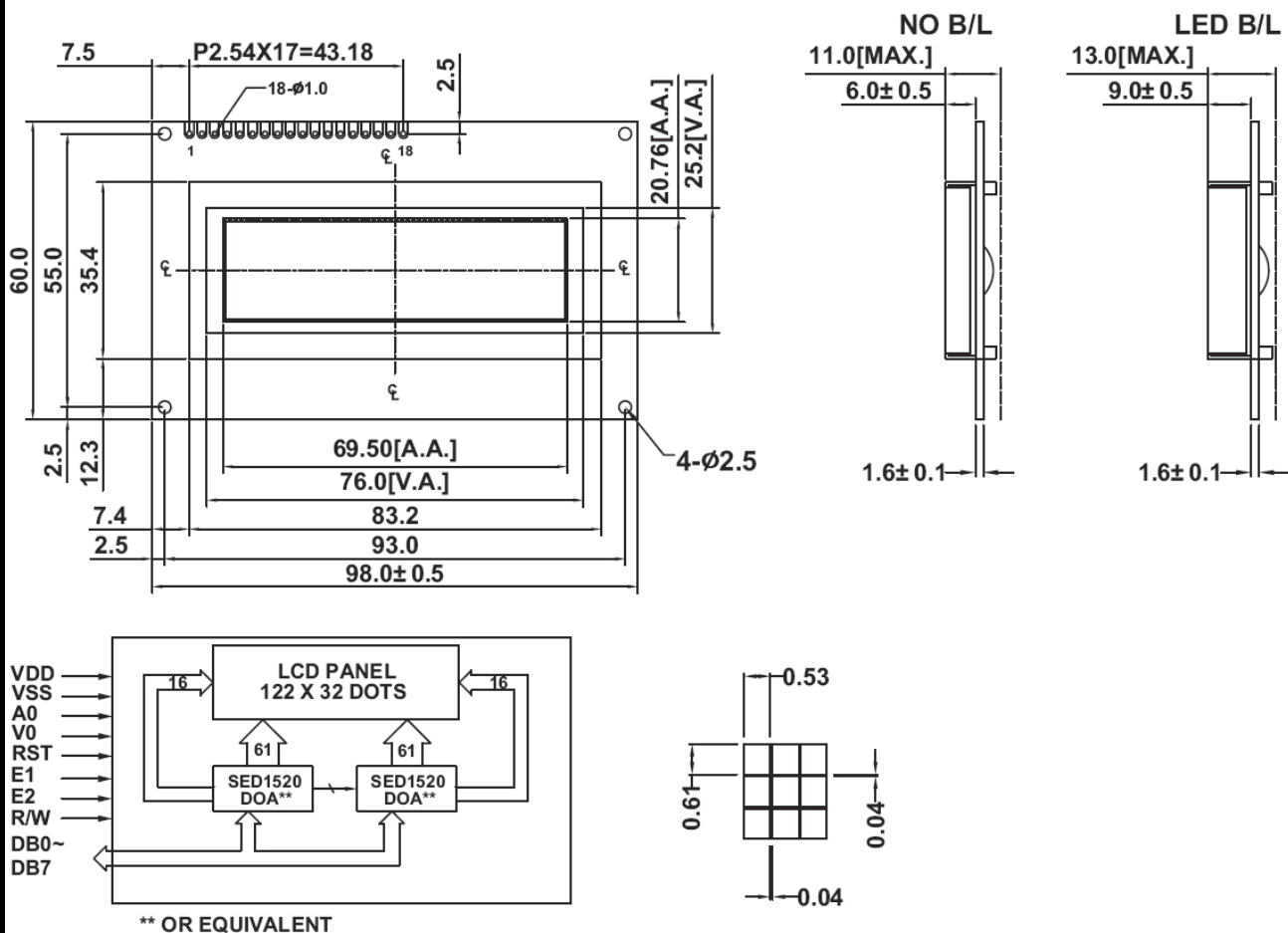

Vdd-V0: LCD Driving Voltage
      VR: 10K - 20K

DUAL SUPPLY VOLTAGE TYPE (for LCM without Negative Power on PCB)

Vdd-V0: LCD Driving Voltage
      VR: 10K - 20K

9. Contour Drawing &Block Diagram

NO B/L
11.0[MAX.]
6.0± 0.5
1.6± 0.1

LED B/L
13.0[MAX.]
9.0± 0.5
1.6± 0.1

7.5 P2.54X17=43.18 2.5
18-Ø1.0
1 18
20.76[A.A.]
25.2[V.A.]
60.0 55.0 35.4
2.5 12.3
69.50[A.A.]
76.0[V.A.]
4-Ø2.5
7.4 83.2
2.5 93.0
98.0± 0.5

VDD
VSS
A0
V0
RST
E1
E2
R/W
DB0~
DB7

16 **LCD PANEL 122 X 32 DOTS** 16
61 61
SED1520 DOA** **SED1520 DOA****

** OR EQUIVALENT

0.53
0.61 0.04
0.04

10.Timing Characteristics

● AC Characteristics
○ Read/Write timing for the 80-port MPU

(Ta = –20 to 75°C, Vss = –5.0V±10%)

Parameter	Signal	Symbol	Condition	Rating			Unit
				Min	Typ	Max	
Address hold time	A0, $\overline{CS}$	t_{AHB}		10	—	—	ns
Address set-up time		t_{AWB}		20	—	—	ns
System cycle time	$\overline{WR}$, $\overline{RD}$	t_{CYC8}		1000	—	—	ns
Control pulse width		t_{CC}		200	—	—	ns
Data set-up time	D0 ~ D7	t_{DS8}		80	—	—	ns
Data hold time		t_{DH8}		10	—	—	ns
$\overline{RD}$ access time		t_{ACC8}	C_L = 100pF	—	—	90	ns
Output disable time		t_{OH8}		10	—	60	ns

*2. The ratings when Vss = –3.0V are approximately 100% higher than when Vss = –5.0V.

○ Read/Write timing for the 68-port MPU

(Ta = –20 to 75°C, Vss = –5.0V±10%)

Parameter		Signal	Symbol	Condition	Rating			Unit
					Min	Typ	Max	
System cycle time		A0, $\overline{CS}$ R/$\overline{W}$	t_{CYC6} *3		1000	—	—	ns
Address set-up time			t_{AW6}		20	—	—	ns
Address hold time			t_{AH6}		10	—	—	ns
Data set-up time		D0 ~ D7	t_{DS6}		80	—	—	ns
Data hold time			t_{DH6}		10	—	—	ns
Output disable time			t_{OH6}	C_L = 100pF	10	—	60	ns
Access time			t_{ACC6}		—	—	90	ns
Enable pulse width	READ	E	t_{ew}		100	—	—	ns
	WRITE				80	—	—	ns

*3. t_{CYC6} indicates the cycle during which $\overline{CS}$/E are HIGH; it does not indicate the cycle of the E signal.
*4. The ratings when Vss = –3.0V are approximately 100% higher than when Vss = –5.0V.

○ Control timing for 80-port/68-port display

(Ta = –20 to 75°C, Vss = –5.0V±10%)

Parameter	Signal	Symbol	Condition	Rating			Unit
				Min	Typ	Max	
LOW pulse width	CL	t_{WLCL}		35	—	—	µs
HIGH pulse width		t_{WHCL}		35	—	—	µs
Rising time		t_r		—	30	150	ns
Falling time		t_f		—	30	150	ns
FR delay time	FR	t_{DFR}	(Input timing)	–2.0	0.2	2.0	µs
			(Output timing), C_L = 100pF	—	0.2	0.4	

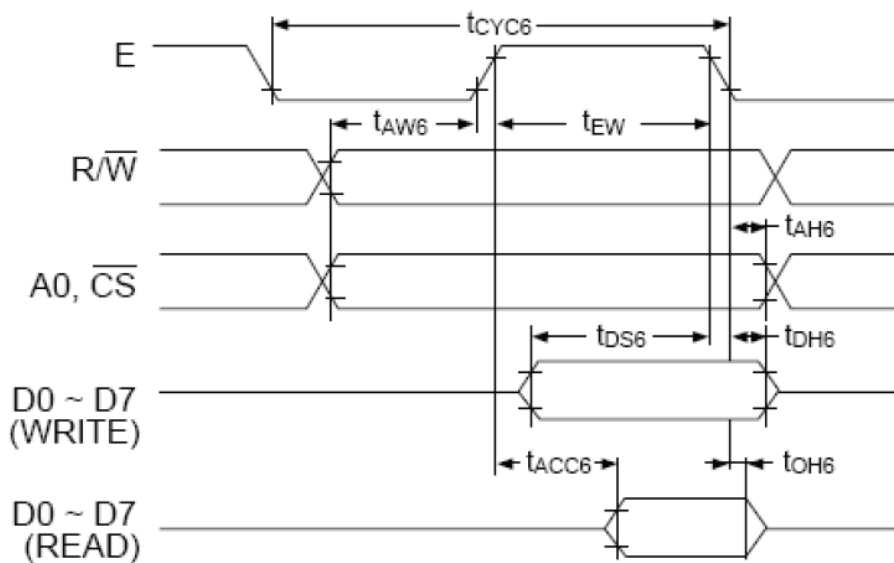*5. The ratings when Vss = –3.0V are approximately 100% higher than when Vss = –5.0V.
*6. The input timing of the FR delay time is determined by the SED1520 (Slave).
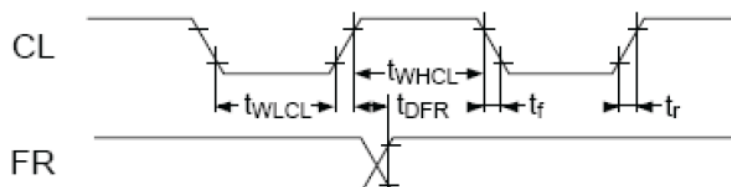   The output timing of the FR delay time is determined by the SED1520 (Master).

- Timing Chart
- Read/Write timing for the 80-port MPU
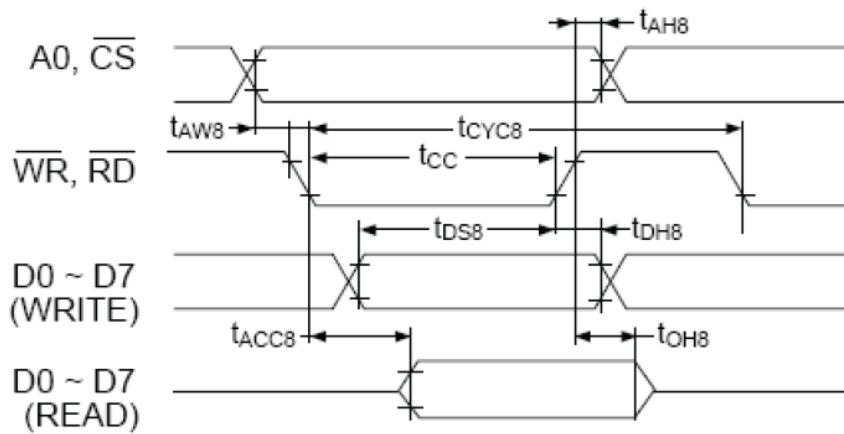
- Read/Write timing for the 68-port MPU

- Control timing for 80-port/68-port display

11.Instruction Table

■ **DISPLAY COMMANDS**
(Based on the 80-port MPU; the $\overline{RD}$ and $\overline{WR}$ commands differ for the 68-port MPU.)

	Command	$\overline{RD}$	$\overline{WR}$	A0	D7	D6	D5	D4	D3	D2	D1	D0	Function	
1	Display ON/OFF	1	0	0	1	0	1	0	1	1	1	0/1	Switches the entire display ON or OFF, regardless of the Display RAM's data or the internal status. *7	
2	Display START Line	1	0	0	1	1	0	Display START address (0~31)					Determines the line of RAM data to be displayed at the display's top line (COM0).	
3	Page Address Set	1	0	0	1	0	1	1	1	0	Page (0~3)		Sets the page of the Display RAM in the page address register.	
4	Column (Segment) Address Set	1	0	0	0	Column address (0~79)								Sets the column address of the Display RAM in the column address register.	
5	Status Read	0	1	0	BUSY	ACC	ON/OFF	RESET	0	0	0	0	Reads the status. BUSY 1: Busy (internal processing) 0: READY status ADC 1: Rightward (forward) output 0: Leftward (reverse) output ON/OFF 1: Display OFF 0: Display ON RESET 1: Resetting 0: Normal	
6	Write Display Data	1	0	1	Write Data								Writes the data on the data bus to RAM	These commands access a previously-specified
7	Read Display Data	0	1	1	Read Data								Reads data from the Display RAM onto the data bus.	address of the Display RAM, after which the column address is incremented by one.
8	ADC Select	1	0	0	1	0	1	0	0	0	0	0/1	Used to reverse the correspondence between the Display RAM's column addresses and segment driver output ports 0: Rightward (forward) output 1: Leftward (reverse) output	
9	Static Drive ON/OFF	1	0	0	1	0	1	0	0	1	0	0/1	Selects normal display operation or static all-lit drive display operation. 1: Static drive (Power Save) *7 0: Normal display operation	
10	Duty Select	1	0	0	1	0	1	0	1	0	0	0/1	Selects the duty factor for driving LCD cells. 1: 1/32 duty 0: 1/16 duty	
11	Read Modify Write	1	0	0	1	1	1	0	0	0	0	0	Increments the column address counter by one only when display data is written but not when it is read.	
12	End	1	0	0	1	1	1	0	1	1	1	0	Cancels the Ready Modify Write mode.	
13	Reset	1	0	0	1	1	1	0	0	0	1	0	Resets the Display START line to the 1st line in the register. Resets the column address counter to 0 and page address register to 3.	

*7. Power Save mode is entered by selecting static drive in Display OFF status.
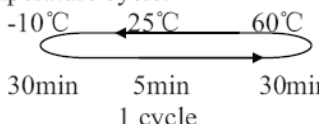
12.Quality Assurance

Screen Cosmetic Criteria

Item	Defect	Judgment Criterion	Partition
1	Spots	A)Clear <u>Size: d mm</u> <u>Acceptable Qty in active area</u> $d \leqq 0.1$ Disregard $0.1<d\leqq0.2$ 6 $0.2<d\leqq0.3$ 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> $d \leqq 0.2$ Disregard $0.2<d\leqq0.5$ 6 $0.5<d\leqq0.7$ 2 $0.7<d$ 0	Minor
2	Bubbles in Polarizer	<u>Size: d mm</u> <u>Acceptable Qty in active area</u> $d\leqq0.3$ Disregard $0.3<d\leqq1.0$ 3 $1.0<d\leqq1.5$ 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℃ 96hrs	____
Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-10℃ 96hrs	____
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	50℃ 96hrs	____
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	0℃ 96hrs	____
High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	60℃,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℃,90%RH 96hrs	____
Temperature Cycle	Endurance test applying the low and high temperature cycle. -10℃ 25℃ 60℃ 30min 5min 30min 1 cycle	-10℃/60℃ 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 msedc 3 times of each direction	____

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