



## PRODUCT SPECIFICATION

*Part Number*

PG12864A-O Series

CUSTOMER	
CUSTOMER PART NUMBER	
DESCRIPTION	
APPROVED BY	
DATE	



**MODEL NO.**

**PAGE**

PG12864A-O series

SPEC ONLY

2

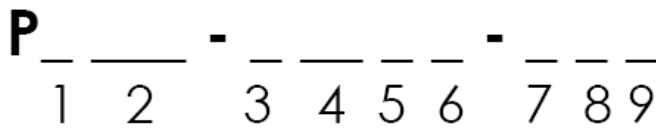
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# 1. Part number breakdown



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

1. P-tec LCD Type	<b>C</b> = Character <b>G</b> = Graphic <b>COG</b> = Chip On Glass	<b>COF</b> = Chip On Flex <b>TAB</b> = Tape Automated Bonding <b>TFT</b> = Thin-film Transistor
2. LCD Model	Example for Character: <b>2002A</b> = 20 Characters x 2 Lines w/ Pins on Left side and 116mm x 37 x 12.7mm overall size Example for Graphic: <b>12864B</b> = 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	<b>T</b> = TN/Grey <b>Y</b> = STN/Yellow Green <b>G</b> = STN/ Grey	<b>B</b> = STN/ Blue <b>F</b> = FSTN/ White <b>N</b> = FSTN/ Black
4. Backlight/polorizer	<b>NF</b> = None/Transflective <b>NM</b> = None/Transmissive <b>NR</b> = None/Reflective <b>EF</b> = EL/Transflective <b>EM</b> = EL/Transmissive	<b>LF</b> = LED/Transflective <b>LM</b> = LED/Transmissive <b>CF</b> = CCFL/Transflective <b>CM</b> = CCFL=Transmissive
5. Backlight Color	(If no backlight provided move on to viewing angle [6.]) <b>B</b> = Blue/Green <b>Y</b> = Yellow <b>G</b> = Green	
6. Viewing Angle	<b>D</b> = 6:00 <b>U</b> = 12:00	<b>R</b> = 3:00 <b>L</b> = 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**

<b>Item</b>	<b>Dimension</b>	<b>Unit</b>
Number of Dots	128 x 64	—
Module dimension(No Backlight )	93.0 x 70.0 x 10.0 (MAX)	mm
Module dimension(With LED Backlight )	93.0 x 70.0 x 14.0 (MAX)	mm
View area	72.0 x 40.0	mm
Active area	66.52 x 33.24	mm
Dot size	0.48 x 0.48	mm
Dot pitch	0.52 x 0.52	mm
LCD type	STN	
Duty	1/64	
View direction	6 o'clock or 12 o'clock	
Backlight Type	None, YELLOW-GREEN or WHITE backlight	

## 4. Absolute Maximum Ratings

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

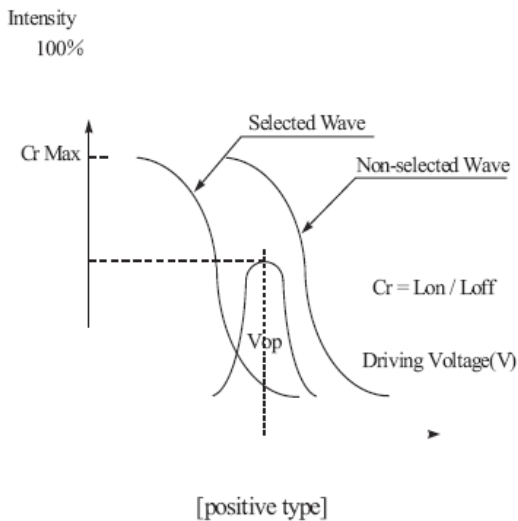
## 5. Electrical Characteristics

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	$V_{DD}-V_0$	$T_a=25^{\circ}\text{C}$	10.8	13.0	13.6	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	$I_{DD}$	$V_{DD}=5\text{V}$	3.2	3.9	4.3	mA
Supply Voltage of Yellow-green backlight	$V_{LED}$	Forward current =330 mA Number of LED die 2x33= 66	3.8	4.1	4.3	V
Supply Voltage of White backlight	$V_{LED}$	Forward current =120 mA Number of LED die 1x6= 6	3.8	4.0	4.3	V

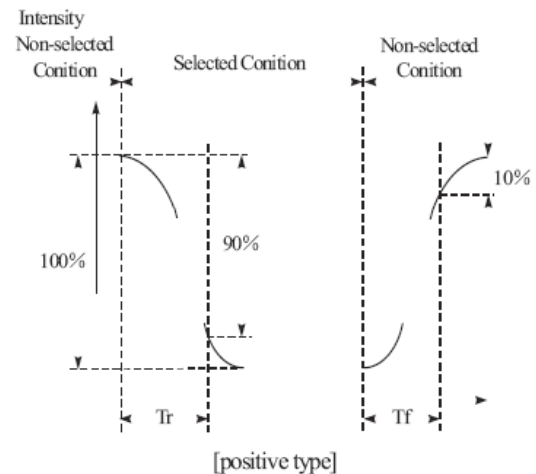
## 6. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V) $\theta$	$CR \geq 2$	-20	—	35	deg
	(H) $\phi$	$CR \geq 2$	-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)



### Conditions :

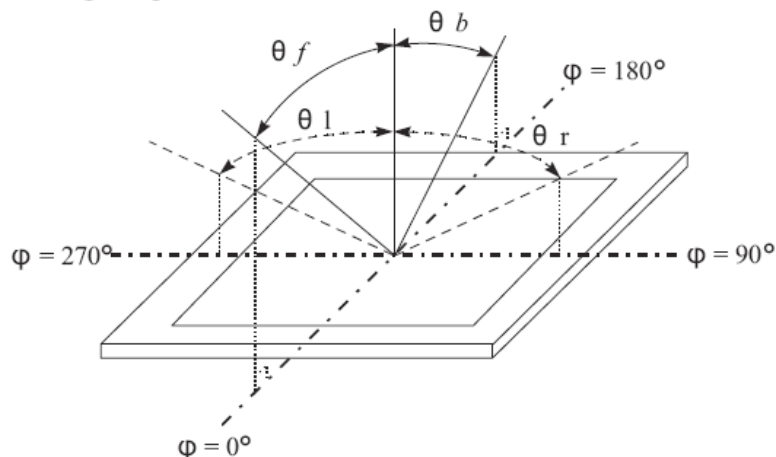
Operating Voltage : Vop

 Viewing Angle( $\theta$ ,  $\phi$ ) :  $0^\circ$ ,  $0^\circ$ 

Frame Frequency : 64 HZ

Driving Waveform : 1/N duty, 1/a bias

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



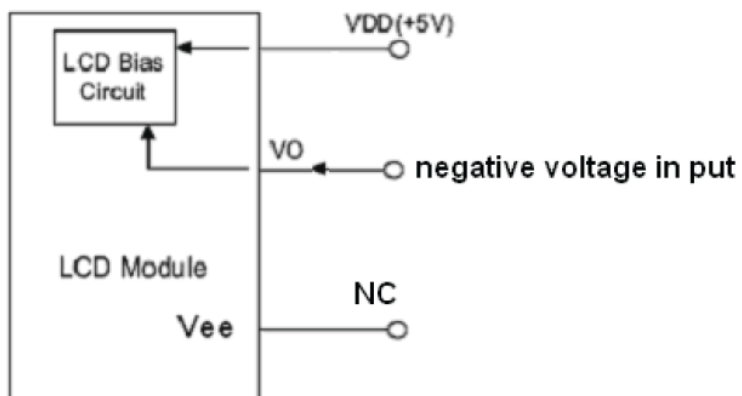
## 7. Interface Pin Function

Pin No.	Symbol	Level	Description
1	V <sub>SS</sub>	0V	Ground
2	V <sub>DD</sub>	5.0V	Supply Voltage for logic
3	V <sub>0</sub>		Supply voltage for LCD
4	RS	H/L	Register Select
5	R/W	H/L	Read/Write
6	E	H/L	Enable
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	CS1	H/L	Chip1 select signal, Active High, Left Part
16	CS2	H/L	Chip2 select signal, Active High, Right Part
17	RST	H/L	Reset Signal
18	V <sub>ee</sub>		Negative Voltage Output
19	LED(+)		Anode of LED Backlight
20	LED(-)		Cathode of LED Backlight



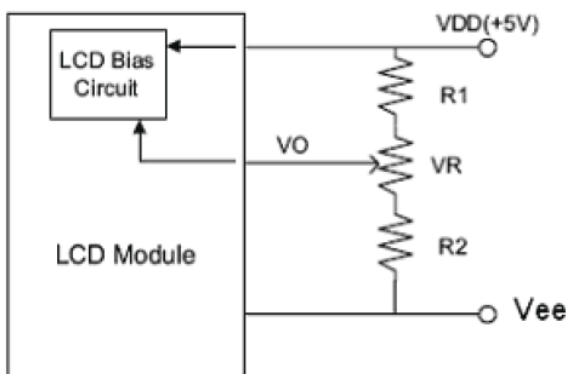
## 8. POWER SUPPLY

### Without Negative Power on PCB



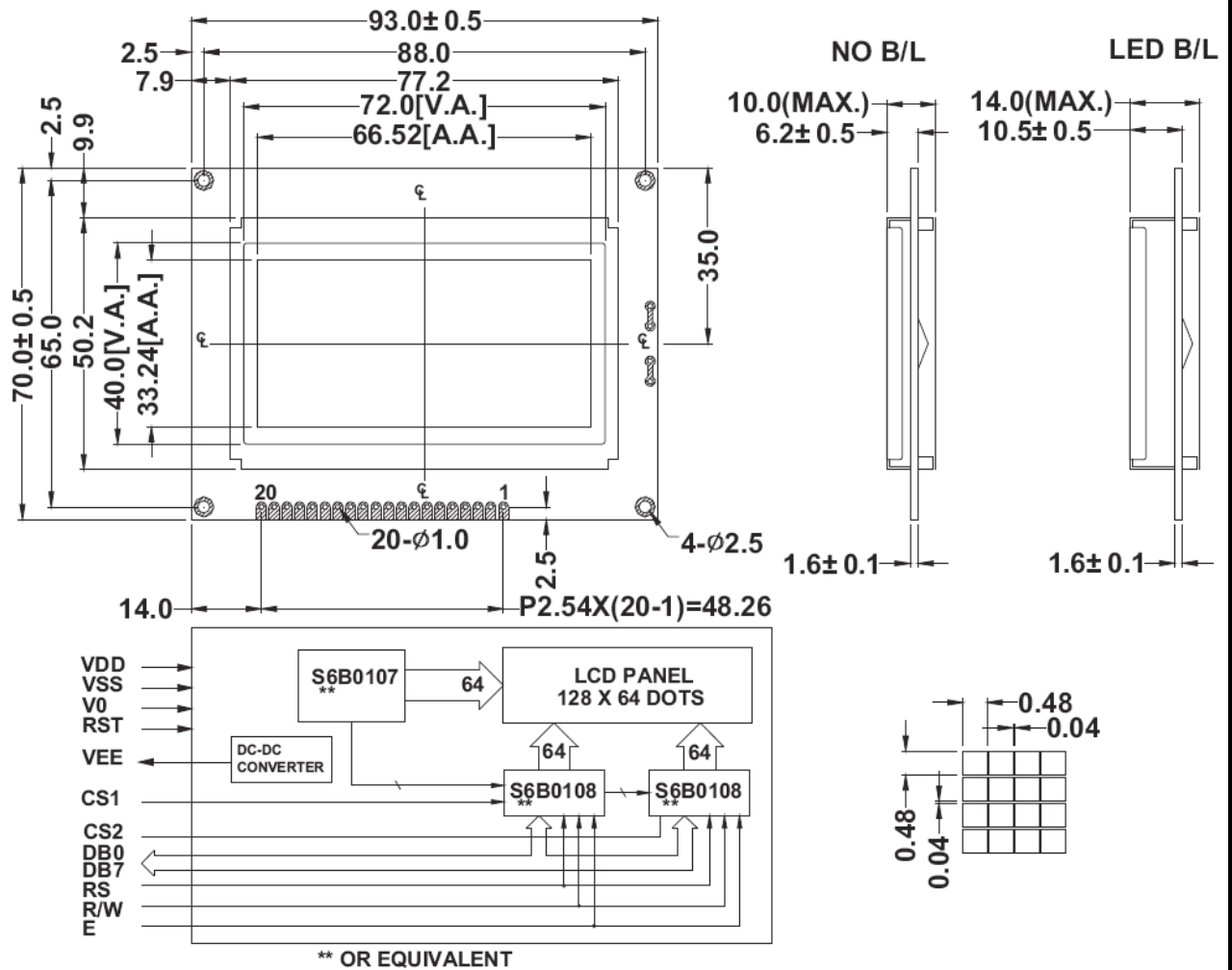
without DC-DC converter

### With Negative Power on PCB



with DC-DC converter  
VR:10K-20K

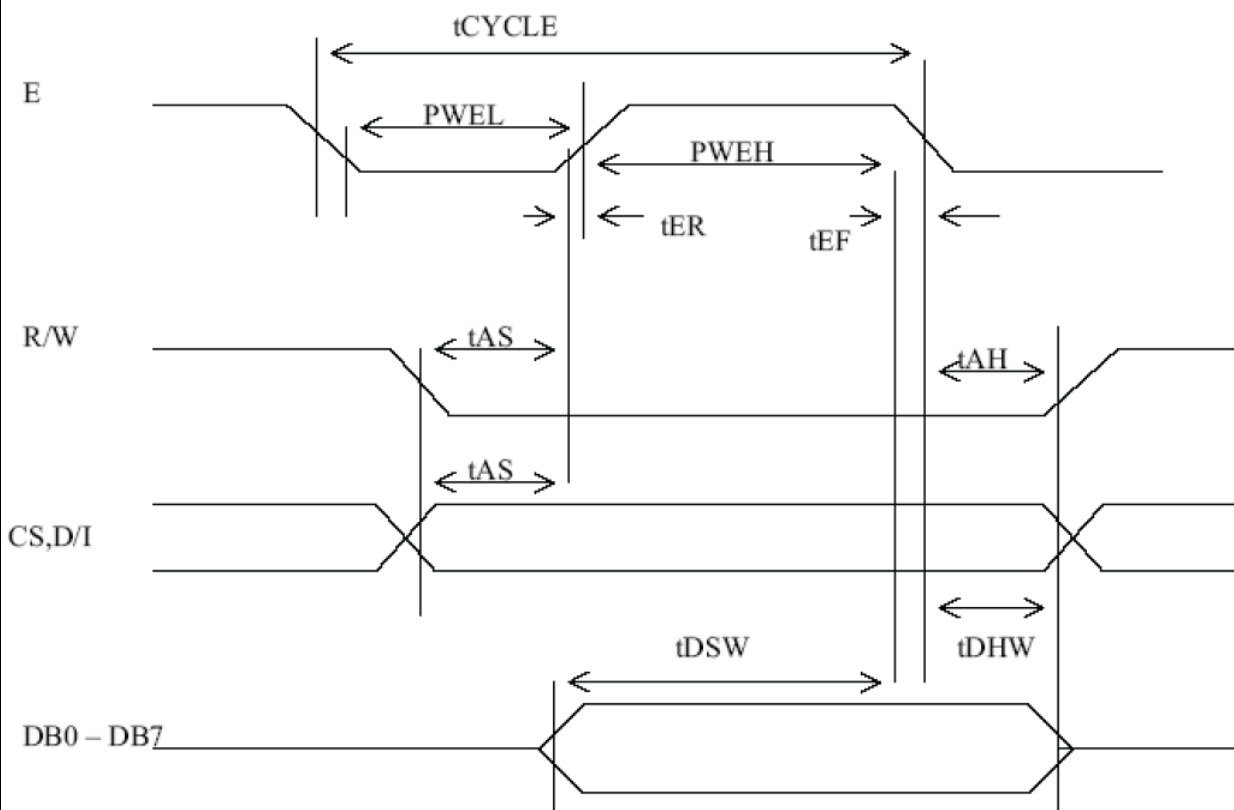
## 9. Contour Drawing & Block Diagram



## 10. Timing Characteristics

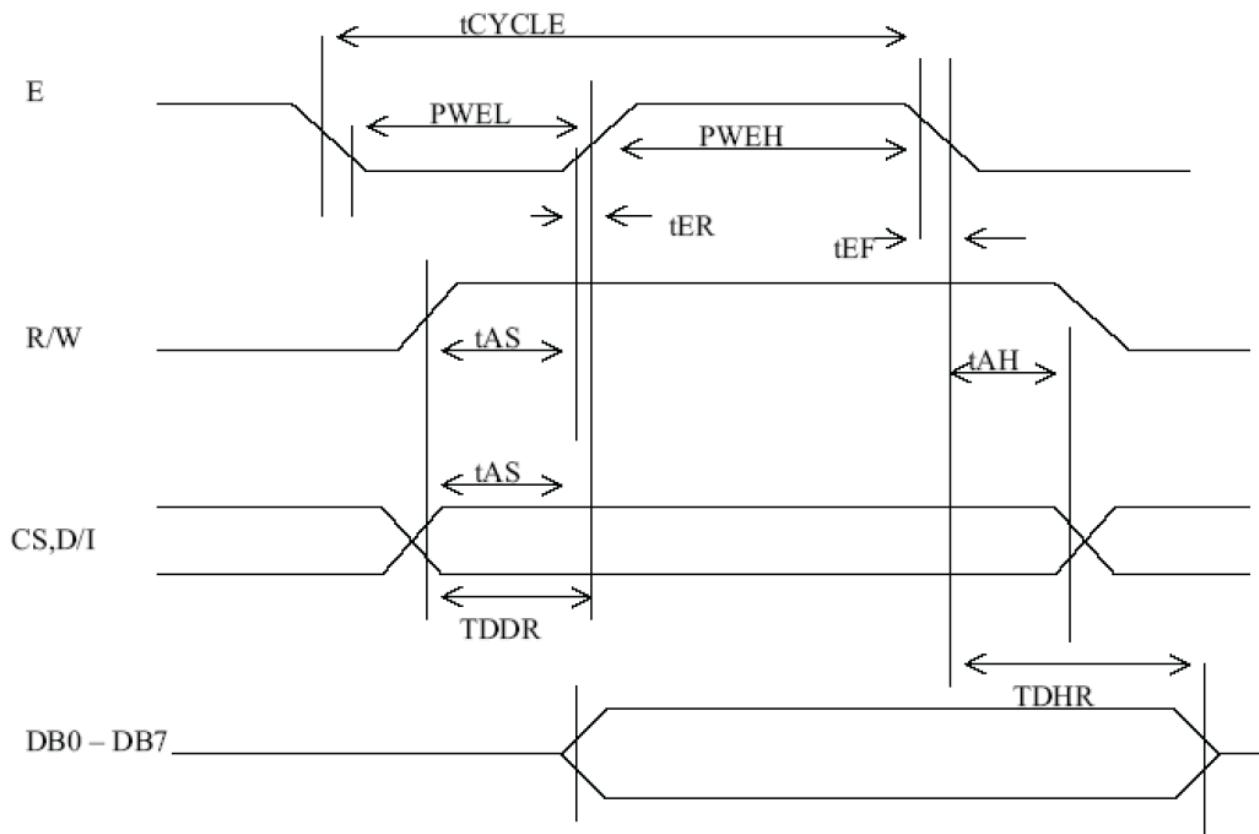
### 10.1 WRITING OPERATION

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
ENABLE CYCLE TIME	$t_{\text{CYCLE}}$	1.0	-	-	us
ENABLE PULSE WIDTH	HIGH LEVEL	PWEH	450	-	ns
	LOW LEVEL	PWEL	450	-	ns
ENABLE RISE & FALL TIME	$t_{\text{ER}}, t_{\text{EF}}$	-	-	25	ns
ADDRESS SET-UP TIME	$t_{\text{AS}}$	140	-	-	ns
ADDRESS HOLD TIME	$t_{\text{AH}}$	10	-	-	ns
DATA SET-UP TIME	$t_{\text{DSW}}$	200	-	-	ns
DATA HOLD TIME	$t_{\text{DHW}}$	10	-	-	ns



## 10.1 READ OPERATION

ITEM		SYMBOL	MIN	TYP	MAX	UNIT
ENABLE CYCLE TIME		$t_{\text{CYCLE}}$	1.0	-	-	us
ENABLE PULSE WIDTH	HIGH LEVEL	PWEH	450	-	-	ns
	LOW LEVEL	PWEL	450	-	-	ns
ENABLE RISE & FALL TIME		$t_{\text{ER}}, t_{\text{EF}}$	-	-	25	ns
ADDRESS SET-UP TIME		$t_{\text{As}}$	140	-	-	ns
ADDRESS HOLD TIME		$t_{\text{AH}}$	10	-	-	ns
DATA SET-UP TIME		$t_{\text{DDR}}$	-	-	320	ns
DATA HOLD TIME		$t_{\text{DHW}}$	20	-	-	ns



## 11. Instruction Table

The display control instructions control the internal state of the KS0108B. Instruction is received from MPU to KS0108B for the display control. The following table shows various instructions.

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function	
Display ON/OFF	L	L	L	L	H	H	H	H	H	L/H	Controls the display on or off. Internal status and display RAM data is not affected. L:OFF, H:ON	
Set Address (Y address)	L	L	L	H	Y address (0~63)						Sets the Y address in the Y address counter.	
Set Page (X address)	L	L	H	L	H	H	H	Page (0~7)			Sets the X address at the X address register.	
Display Start Line (Z address)	L	L	H	H	Display start line (0~63)						Indicates the display data RAM displayed at the top of the screen.	
Status Read	L	H	B U S Y	L	O N / O F F	R E S E T	L	L	L	L	Read status. BUSY L: Ready H: In operation ON/OFF L: Display ON H: Display OFF RESET L: Normal H: Reset	
Write Display Data	H	L	Write Data									Writes data (DB0:7) into display data RAM. After writing instruction, Y address is increased by 1 automatically.
Read Display Data	H	H	Read Data									Reads data (DB0:7) from display data RAM to the data bus.

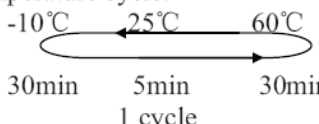
## 12. Quality Assurance

### 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