

## SPECIFICATIONS

**CUSTOMER** : \_\_\_\_\_  
**SAMPLE CODE (Ver.)** : \_\_\_\_\_  
**MASS PRODUCTION CODE (Ver.)** : PC2004WRF-AWB-B-Q(Ver.B)  
**DRAWING NO. (Ver.)** : HLMD-PC2004WRF-AWB-B-Q (Ver.001)

**Customer Approved**

**Date:**

| Approved | QC Confirmed | Designer |
|----------|--------------|----------|
| 蔡志傳      | 蔡志傳          | 楊清龍      |

☐ Approval For Specifications Only.

\* This specification is subject to change without notice.

Please contact Powertip or it's representative before designing your product based on this specification.

☒ Approval For Specifications and Sample.

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(#081160)

NO.PT-A-005-6

## RECORDS OF REVISION

| Date       | Rev. | Description                                                                                     | Note | Page  |
|------------|------|-------------------------------------------------------------------------------------------------|------|-------|
| 2006/01/10 | 0    | PC2004WRF-AWB-B-Qis the ROHS compliant part number based on Powertip's standard PC2004WRF-AWB-B |      |       |
| 2007/10/7  | A    | Update Timing Characteristics and Display Command                                               |      | 13,15 |
| 2009/10/07 | B    | Update LCM Drawing                                                                              |      | 8     |
|            |      |                                                                                                 |      |       |
|            |      |                                                                                                 |      |       |
|            |      |                                                                                                 |      |       |
|            |      |                                                                                                 |      |       |
|            |      |                                                                                                 |      |       |
|            |      |                                                                                                 |      |       |
|            |      |                                                                                                 |      |       |

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### **6. THIS PRODUCT CONFORMS THE ROHS OF PTC.**

**Note :** For detailed information please refer to IC data sheet : [ST7066U](#)

## 1. SPECIFICATIONS

### 1.1 Features

| Item              | Standard Value                                    |
|-------------------|---------------------------------------------------|
| Display Type      | 20 *4 Characters                                  |
| LCD Type          | FSTN, White Transflective, Positive, Normal Temp. |
| Driver Condition  | LCD Module 1/16 Duty , 1/5Bias                    |
| Viewing Direction | 6 O'clock                                         |
| Backlight         | white LED B/L                                     |
| Weight            | 70.0g                                             |
| Interface         | —                                                 |
| Other             |                                                   |

### 1.2 Mechanical Specifications

| Item              | Standard Value                     | Unit |
|-------------------|------------------------------------|------|
| Outline Dimension | 98.0 (L) * 60.0 (w) *13.3 (H)(Max) | mm   |
| Viewing Area      | 76.0 (L) * 25.2 (w)                | mm   |
| Active Area       | 70.4 (L) *20.8 (w)                 | mm   |
| Dot Size          | 0.55 (L) * 0.55 (w)                | mm   |
| Dot Pitch         | 0.60(L) * 0.60(w)                  | mm   |

Note : For detailed information please refer to LCM drawing

### 1.3 Absolute Maximum Ratings

| Item                      | Symbol    | Condition                          | Min.          | Max.         | Unit |
|---------------------------|-----------|------------------------------------|---------------|--------------|------|
| Power Supply Voltage      | $V_{DD}$  | —                                  | -0.3          | 7.0          | V    |
| LCD Driver Supply Voltage | $V_{LCD}$ | —                                  | $V_{DD}-10.0$ | $V_{DD}+0.3$ | V    |
| Input Voltage             | $V_{IN}$  | —                                  | -0.3          | $V_{DD}+0.3$ | V    |
| Operating Temperature     | $T_{OP}$  | Excluded B/L                       | 0             | 50           | °C   |
| Storage Temperature       | $T_{ST}$  | Excluded B/L                       | -20           | 70           | °C   |
| Storage Humidity          | $H_D$     | $T_a < 40\text{ }^{\circ}\text{C}$ | -             | 90           | %RH  |

## 1.4 DC Electrical Characteristics

$V_{DD} = 5.0 \pm 0.5V$  ,  $V_{SS} = 0V$  ,  $T_a = 25^\circ C$

| Item                 | Symbol   | Condition         | Min.        | Typ. | Max.     | Unit |
|----------------------|----------|-------------------|-------------|------|----------|------|
| Logic Supply Voltage | $V_{DD}$ | —                 | 4.5         | 5.0  | 5.5      | V    |
| “H” Input Voltage    | $V_{IH}$ | —                 | $0.7V_{DD}$ | -    | $V_{DD}$ | V    |
| “L” Input Voltage    | $V_{IL}$ | —                 | -0.3        | -    | 0.6      | V    |
| “H” Output Voltage   | $V_{OH}$ | $I_{OH} = -0.1mA$ | 3.9         | -    | $V_{DD}$ | V    |
| “L” Output Voltage   | $V_{OL}$ | $I_{OL} = 0.1mA$  | -           | -    | 0.4      | V    |
| Supply Current       | $I_{DD}$ | $V_{DD} = 5.0 V$  |             | 1.5  | 2.0      | mA   |
| LCM Driver Voltage   | $V_{OP}$ | $0^\circ C$       |             |      |          | V    |
|                      |          | $25^\circ C$ *1   | 4.4         | 4.6  | 4.8      |      |
|                      |          | $50^\circ C$      |             |      |          |      |

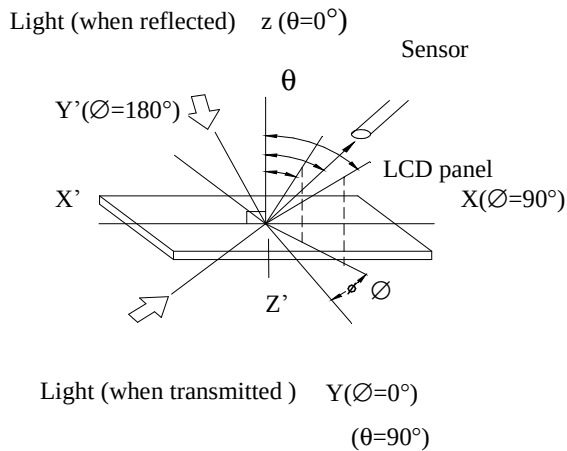
Note: \*1. THE  $V_{OP}$  TEST POINT IS  $V_{DD} - V_O$

## 1.5 Optical Characteristics

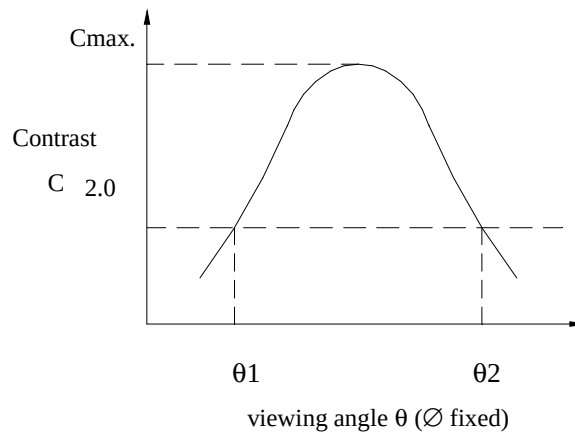
LCD Panel 1/16Duty , 1/4Bias ,  $V_{LCD} = 4.6V$  ,  $T_a = 25^\circ C$

| Item                | Symbol   | Conditions                                | Min. | Typ.  | Max.       | Reference   |
|---------------------|----------|-------------------------------------------|------|-------|------------|-------------|
| View Angle          | $\theta$ | $C \geq 2.0, \varnothing = 0^\circ$       | 0    | -     | $40^\circ$ | Notes 1 & 2 |
| Contrast Ratio      | C        | $\theta = 5^\circ, \varnothing = 0^\circ$ | 6    | 8     | -          | Note 3      |
| Response Time(rise) | tr       | $\theta = 5^\circ, \varnothing = 0^\circ$ | -    | 70 ms | 105 ms     | Note 4      |
| Response Time(fall) | tf       | $\theta = 5^\circ, \varnothing = 0^\circ$ | -    | 150ms | 225 ms     | Note 4      |

### Note 1: Definition of angles $\theta$ and $\varnothing$



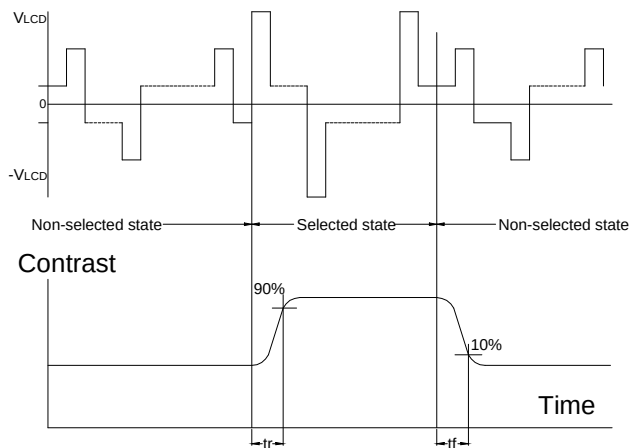
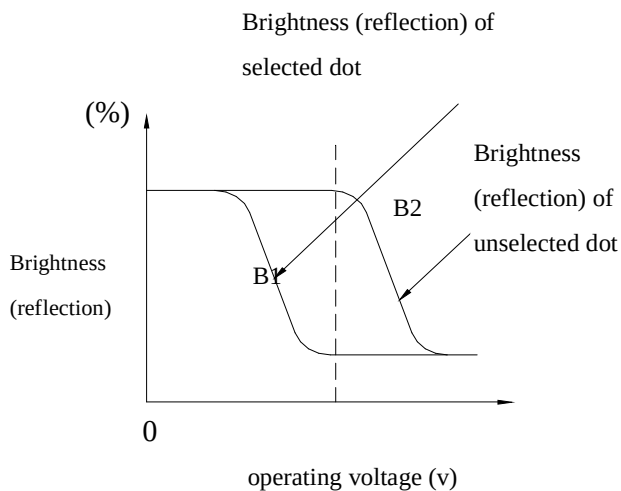
### Note 2: Definition of viewing angles $\theta_1$ and $\theta_2$



Note : Optimum viewing angle with the naked eye and viewing angle  $\theta$  at  $C_{max}$ . 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: Measured with a transmissive LCD panel which is displayed  $1 \text{ cm}^2$

$V_{LCD}$  : Operating voltage  $f_{FRM}$  : Frame frequency

$t_r$  : Response time (rise)  $t_f$  : Response time (fall)

## 1.6 Backlight Characteristics

LCD Module with LED Backlight

Maximum Ratings

| Item              | Symbol | Conditions | Min. | Max. | Unit |
|-------------------|--------|------------|------|------|------|
| Forward Current   | IF     | Ta =25°C   | -    | 72   | mA   |
| Reverse Voltage   | VR     | Ta =25°C   | -    | 5    | V    |
| Power Dissipation | PO     | Ta =25°C   | -    | 0.29 | W    |

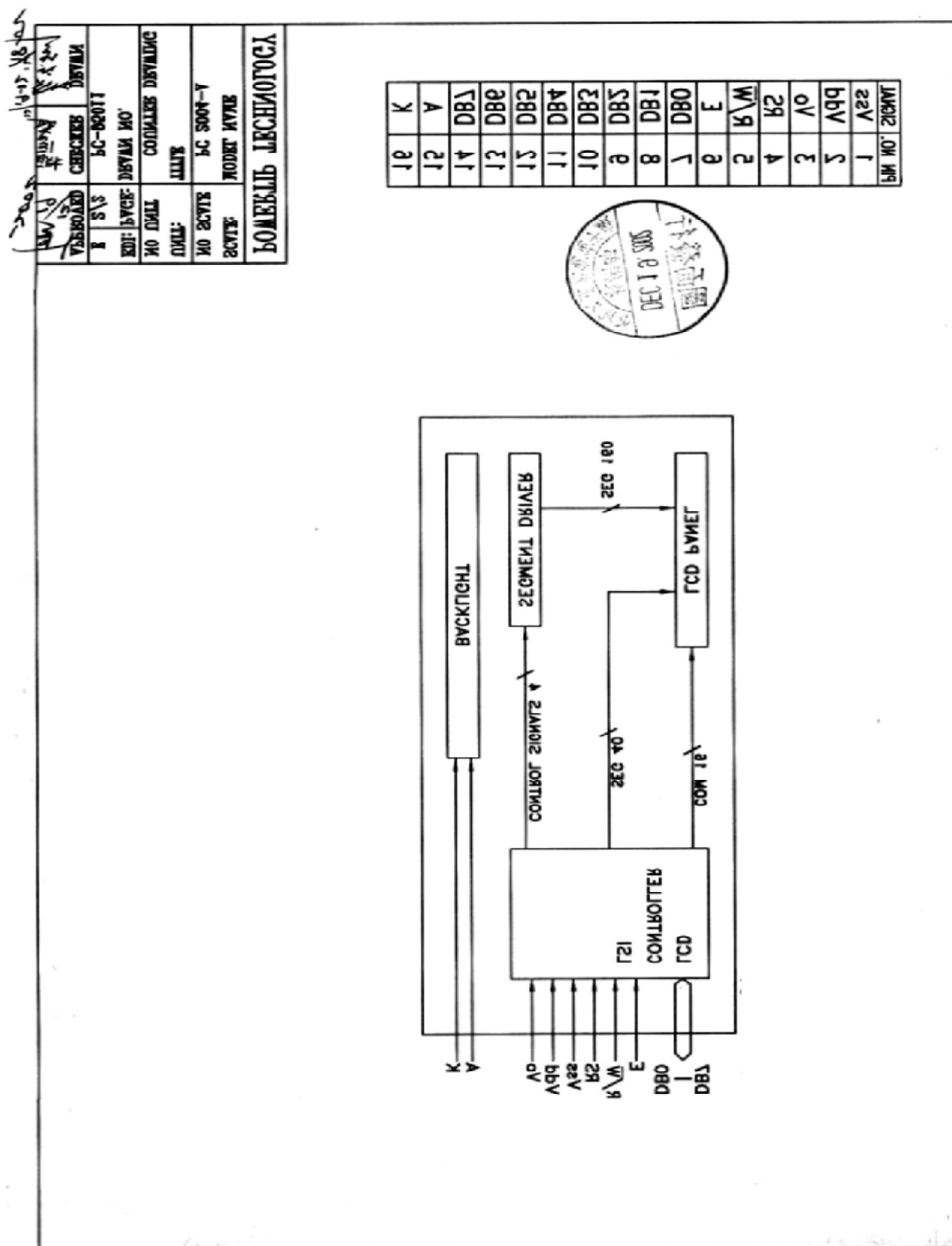
Electrical / Optical Characteristics

Ta =25°C

| Item                                | Symbol | Conditions | Min. | Typ. | Max. | Unit              |
|-------------------------------------|--------|------------|------|------|------|-------------------|
| Forward Voltage                     | VF     | IF= 60 mA  | 3.0  | 3.3  | 4.0  | V                 |
| Reverse Current                     | IR     | VR= 5 V    | -    | -    | 0.15 | mA                |
| Luminous Intensity<br>(Without LCD) | IV     | IF= 60 mA  | 185  | 290  | -    | cd/m <sup>2</sup> |
| Wavelength                          | x      | IF= 60 mA  | 0.26 | 0.29 | 0.32 | nm                |
|                                     | y      |            | 0.27 | 0.30 | 0.33 |                   |
| Color                               | White  |            |      |      |      |                   |



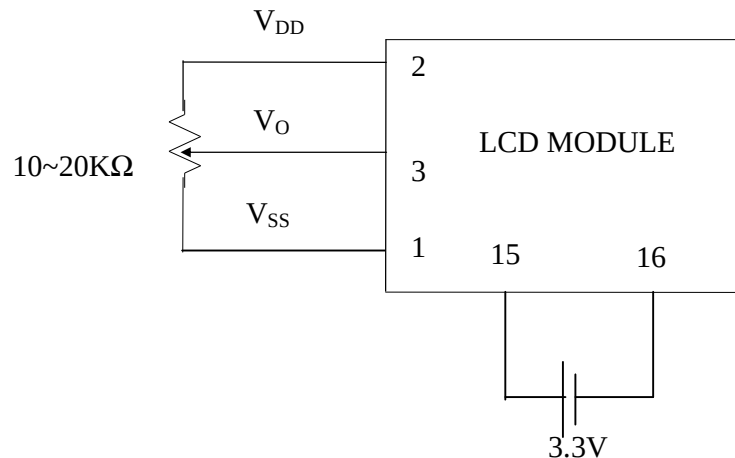




## 2.2 Interface Pin Description

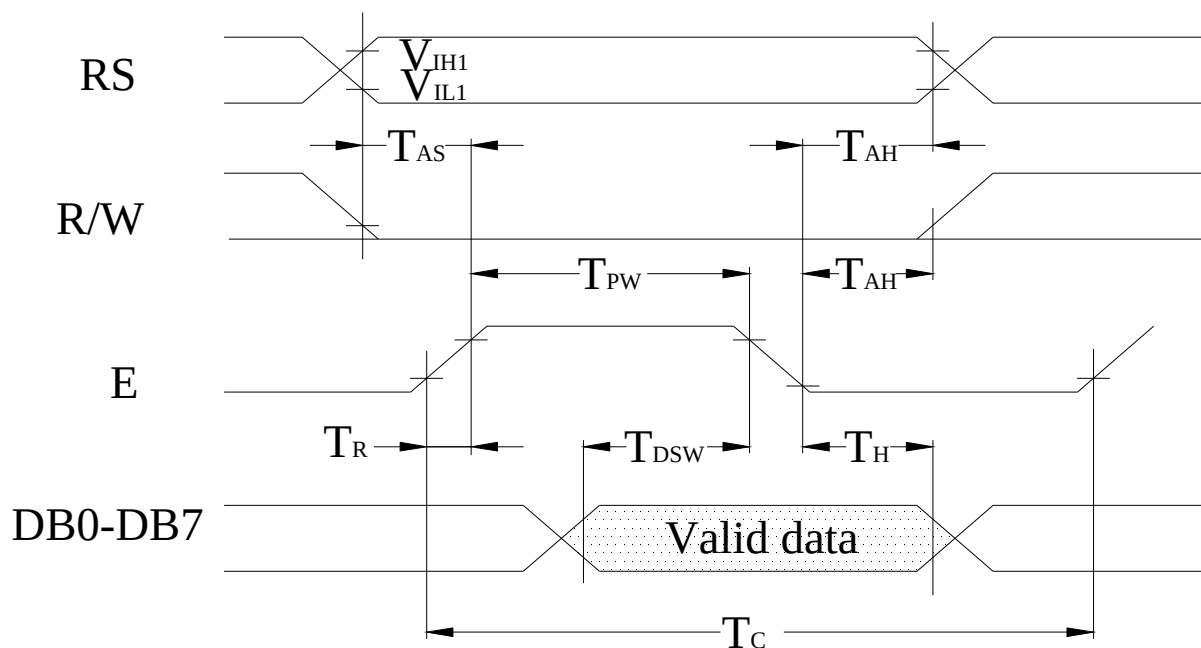
| Pin No. | Symbol           | Signal Description                                                                                                                                                         |
|---------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | VSS              | Power Supply ( $V_{SS}=0$ )                                                                                                                                                |
| 2       | VDD              | Power Supply ( $V_{DD}>V_{SS}$ )                                                                                                                                           |
| 3       | VO               | Operating voltage for LCD (variable)                                                                                                                                       |
| 4       | RS               | Register Selection input<br>High = Data register<br>Low = Instruction register (for write)<br>Busy flag address counter (for read)                                         |
| 5       | $\overline{R/W}$ | Read/Write signal input is used to select the read/write mode.<br>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.<br>Used for data transfer between the MPU and the LCD module.<br>These four are not used during 4-bit operation. |
| 11~14   | DB4 ~ DB7        | Four high order bi-directional three-state data bus lines.<br>Used for data transfer between the MPU and the LCD module.<br>DB7 can be used as a busy flag.                |
| 15      | A                | Power supply for LED B / L (+)                                                                                                                                             |
| 16      | K                | Power supply for LED B / L (-)                                                                                                                                             |

Contrast Adjust

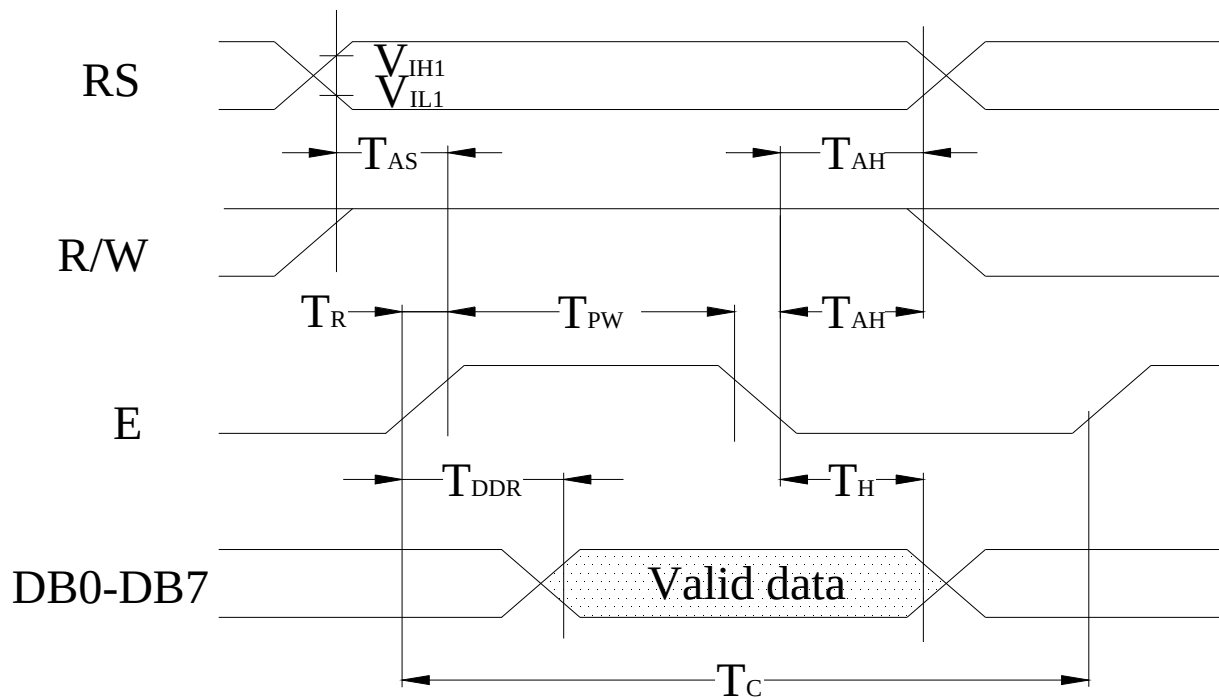


## 2.3 Timing Characteristics

- Writing data from MPU to ST7066U



- l Reading data from ST7066U to MPU



• Write Mode (Writing data from MPU to ST7066U)

(VDD= +5V,Ta=25°C)

| Symbol                          | Characteristics         | Test Condition  | Min. | Typ. | Max. | Unit |
|---------------------------------|-------------------------|-----------------|------|------|------|------|
| T <sub>C</sub>                  | Enable Cycle Time       | Pin E           | 1200 | -    | -    | ns   |
| T <sub>PW</sub>                 | Enable Pulse Width      | Pin E           | 140  | -    | -    | ns   |
| T <sub>R</sub> , T <sub>F</sub> | Enable Rise / Fall Time | Pin E           | -    | -    | 25   | ns   |
| T <sub>AS</sub>                 | Address Setup Time      | Pins: RS , RW,E | 0    | -    | -    | ns   |
| T <sub>AH</sub>                 | Address Hold Time       | Pins :RS,RW,E   | 10   | -    | -    | ns   |
| T <sub>DSW</sub>                | Data Setup Time         | Pins:DB0~DB7    | 40   | -    | -    | ns   |
| T <sub>H</sub>                  | Data Hold Time          | Pins:DB0~DB7    | 10   | -    | -    | ns   |

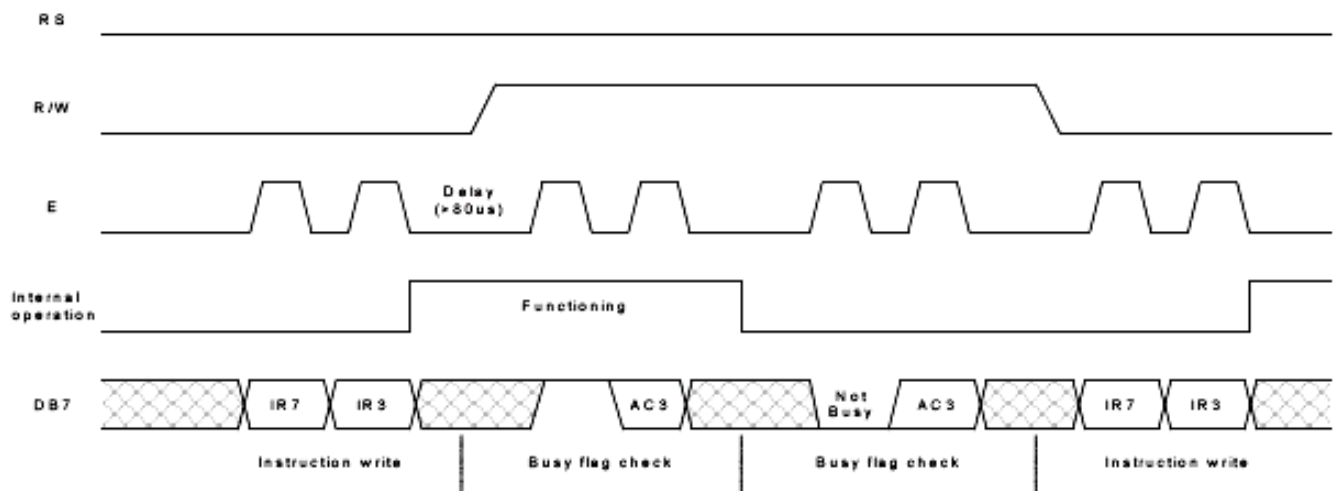
• Read Mode (Reading data from ST7066U to MPU)

(VDD = +5V,Ta=25°C)

| Symbol                          | Characteristics         | Test Condition  | Min. | Typ. | Max. | Unit |
|---------------------------------|-------------------------|-----------------|------|------|------|------|
| T <sub>C</sub>                  | Enable Cycle Time       | Pin E           | 1200 | -    | -    | ns   |
| T <sub>PW</sub>                 | Enable Pulse Width      | Pin E           | 140  | -    | -    | ns   |
| T <sub>R</sub> , T <sub>F</sub> | Enable Rise / Fall Time | Pin E           | -    | -    | 25   | ns   |
| T <sub>AS</sub>                 | Address Setup Time      | Pins: RS , RW,E | 0    | -    | -    | ns   |
| T <sub>AH</sub>                 | Address Hold Time       | Pins :RS,RW,E   | 10   | -    | -    | ns   |
| T <sub>DDR</sub>                | Data Setup Time         | Pins:DB0~DB7    | -    | -    | 100  | ns   |
| T <sub>H</sub>                  | Data Hold Time          | Pins:DB0~DB7    | 10   | -    | -    | ns   |

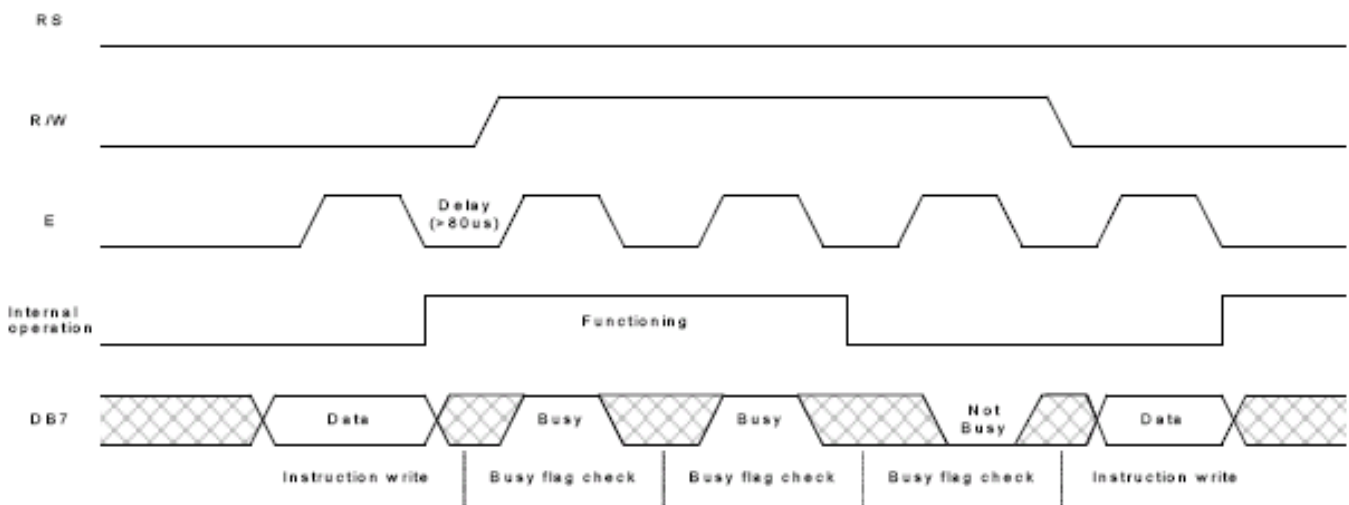
For 4-bit interface date, only four bus lines (DB4 to DB7) are used for transfer.

Example of busy flag check timing sequence



For 8-bit interface date, all eight bus lines (DB0 to DB7) are used .

Example of busy flag check timing sequence



## 2.4 Display Command

| Instructions            | Instruction Code |     |         |         |         |         |         |         |         |         | Description                                                                                                                       | Description Time<br>(270KHz) |
|-------------------------|------------------|-----|---------|---------|---------|---------|---------|---------|---------|---------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------|
|                         | RS               | R/W | DB<br>7 | DB<br>6 | DB<br>5 | DB<br>4 | DB<br>3 | DB<br>2 | DB<br>1 | DB<br>0 |                                                                                                                                   |                              |
| 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     | S       | Sets cursor move direction and specifies display shift. These operations are performed during data write and read .               | 37μs                         |
| Display ON/OFF          | 0                | 0   | 0       | 0       | 0       | 0       | 1       | D       | C       | B       | D=1 : entire display on<br>C=1 : cursor on<br>B=1 : cursor position on                                                            | 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       | ×       | ×       | DL: interface data is 8/4 bits<br>NL: number of line is 2/1<br>F: font size is 5×11/5×8                                           | 37μs                         |
| Set CGRAM Address       | 0                | 0   | 0       | 1       | AC<br>5 | AC<br>4 | AC<br>3 | AC<br>2 | AC<br>1 | AC<br>0 | Set CGRAM address in address counter.                                                                                             | 37μs                         |
| Set DDRAM Address       | 0                | 0   | 1       | AC<br>6 | AC<br>5 | AC<br>4 | AC<br>3 | AC<br>2 | AC<br>1 | AC<br>0 | Set DDRAM address in address counter.                                                                                             | 37μs                         |

|                            |   |   |    |      |      |      |      |      |      |      |                                                                                                                        |            |
|----------------------------|---|---|----|------|------|------|------|------|------|------|------------------------------------------------------------------------------------------------------------------------|------------|
| Read Busy Flag and Address | 0 | 1 | BF | AC 6 | AC 5 | AC 4 | AC 3 | AC 2 | AC 1 | AC 0 | Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read. | 0 $\mu$ s  |
| Write Data to RAM          | 1 | 0 | D7 | D6   | D5   | D4   | D3   | D2   | D1   | D0   | Write data into internal RAM (DDRAM/CGRAM).                                                                            | 37 $\mu$ s |
| Read Data from RAM         | 1 | 1 | D7 | D6   | D5   | D4   | D3   | D2   | D1   | D0   | Read data from internal RAM (DDRAM/CGRAM).                                                                             | 37 $\mu$ s |

Note:

Be sure the ST7066U is not in the busy state (BF=0) before sending an instruction from the MPU to the ST7066.

If an instruction is sent without checking the busy flag , the time between the first instruction and next instruction will take much longer than the instruction time itself.

Before checking BF, be sure to wait at least 80 $\mu$ s.. Do not keep “E” always “High” for checking BF.

Refer to Instruction Table for the list of each instruction execution time .

## 2.5 Character Pattern

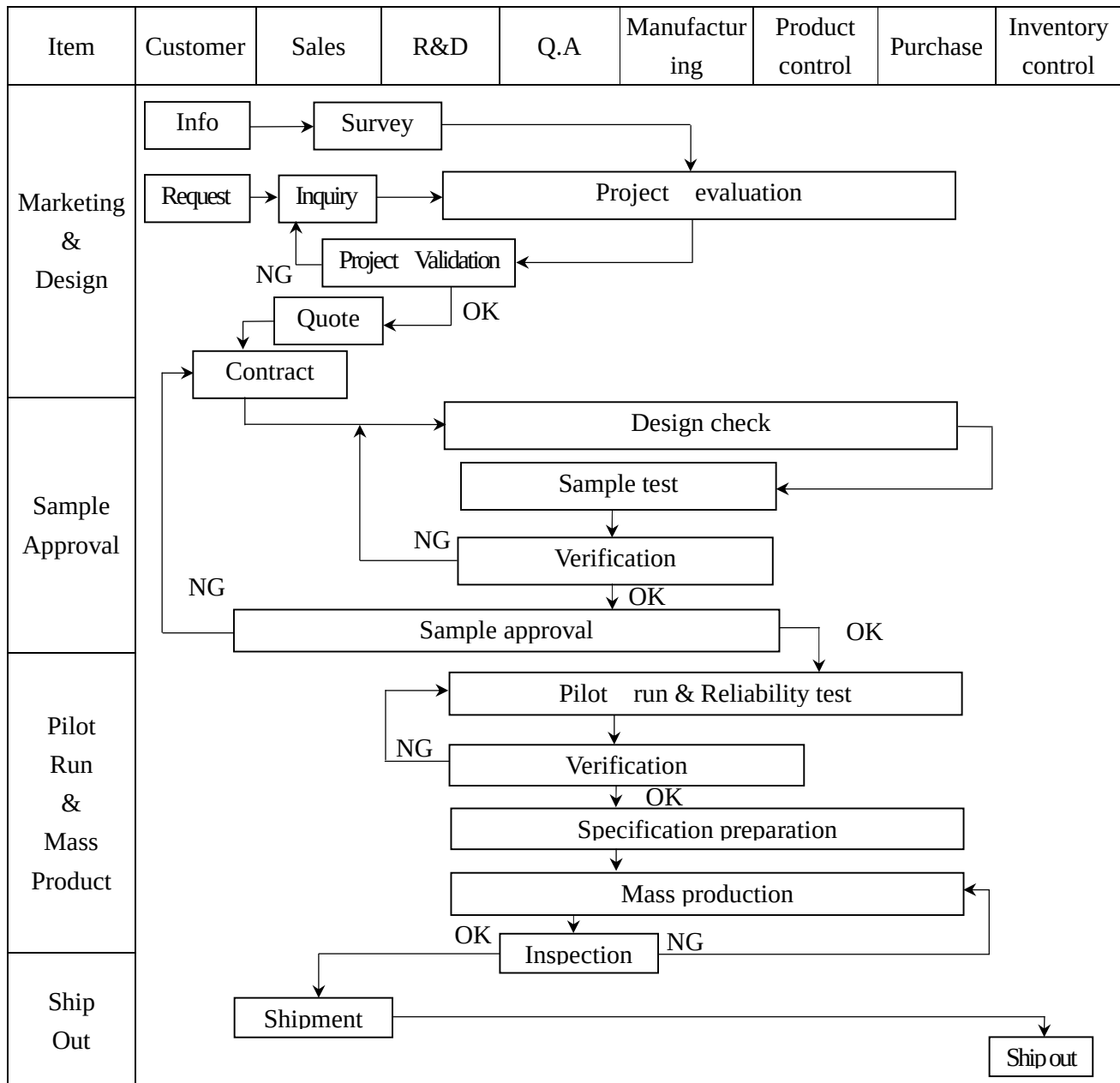
### ■ CHARACTER PATTERN(EB, WB)

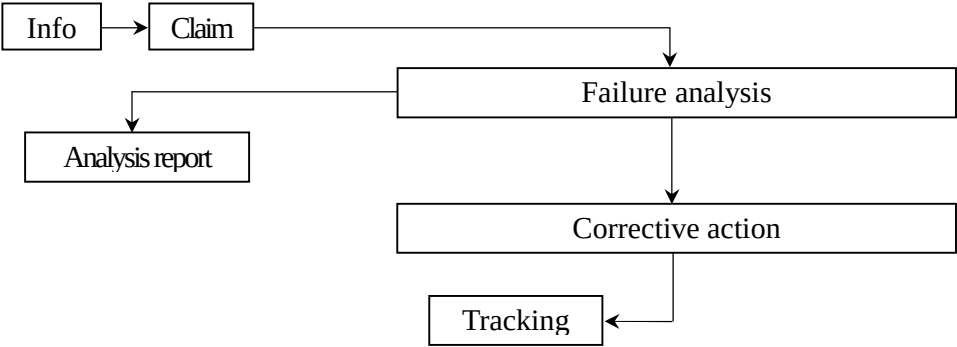
|                                                        |   | High 4-bit (D4 to D7) of Character Code (Hexadecimal) |   |   |   |    |   |   |   |   |   |   |   |   |   |   |   |
|--------------------------------------------------------|---|-------------------------------------------------------|---|---|---|----|---|---|---|---|---|---|---|---|---|---|---|
|                                                        |   | 0                                                     | 1 | 2 | 3 | 4  | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| Lower 4-bit (D0 to D3) of Character Code (Hexadecimal) | 0 | CG RAM (1)                                            | + |   | 0 | 0P | ' | P | 5 | 5 | 5 | 5 | ' | 1 | 5 | 5 | 5 |
|                                                        | 1 | CG RAM (2)                                            | ≡ | ! | 1 | A  | 0 | 2 | 4 | 0 | 2 | 1 | " | J | + | Y | U |
|                                                        | 2 | CG RAM (3)                                            | 7 | " | 2 | B  | R | B | r | 8 | F | 5 | * | w | 5 | 5 | 2 |
|                                                        | 3 | CG RAM (4)                                            | 2 | ≡ | 3 | C  | S | c | 3 | 5 | 0 | c | ' | P | 7 | 5 | 4 |
|                                                        | 4 | CG RAM (5)                                            | 1 | * | 4 | D  | T | 0 | t | 5 | 5 | 0 | ' | 4 | 7 | 5 | 0 |
|                                                        | 5 | CG RAM (6)                                            | 1 | % | 5 | E  | U | e | U | 5 | 5 | 5 | 2 | ↑ | 2 | 7 | 7 |
|                                                        | 6 | CG RAM (7)                                            | 1 | 0 | 5 | F  | V | F | V | 5 | 0 | * | u | ↓ | 5 | 5 | 7 |
|                                                        | 7 | CG RAM (8)                                            | 1 | ' | 7 | B  | W | 9 | w | 5 | 0 | R | x | + | A | 1 | 7 |
|                                                        | 8 | CG RAM (1)                                            | 1 | < | 0 | H  | X | H | x | 5 | 0 | 5 | + | + | 5 | X | 7 |
|                                                        | 9 | CG RAM (2)                                            | 1 | > | 9 | I  | V | i | w | 5 | 9 | i | 2 | 7 | 7 | A | 4 |
|                                                        | A | CG RAM (3)                                            | 5 | * | 5 | J  | Z | u | 2 | 5 | 0 | 5 | 2 | 7 | 2 | u | 7 |
|                                                        | B | CG RAM (4)                                            | 1 | + | 5 | K  | E | k | c | i | R | 5 | * | L | 7 | V | * |
|                                                        | C | CG RAM (5)                                            | ≡ | . | < | L  | \ | i | i | 5 | R | 5 | * | U | 5 | 5 | 0 |
|                                                        | D | CG RAM (6)                                            | 5 | — | — | M  | I | m | > | i | 5 | 5 | * | " | 5 | 7 | — |
|                                                        | E | CG RAM (7)                                            | 5 | ≡ | > | N  | ^ | n | ^ | A | 5 | 5 | 7 | 5 | 5 | P | 5 |
|                                                        | F | CG RAM (8)                                            | 5 | / | ? | 0  | — | 0 | 5 | 5 | 5 | 5 | — | 5 | 5 | 5 | 5 |



### 3. QUALITY ASSURANCE SYSTEM

#### 3.1 Quality Assurance Flow Chart



| Item          | Customer                                                                                                                                                                                                                                                                                            | Sales | R&D | Q.A | Manufacturing                                                           | Product control | Purchase | Inventory control |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----|-----|-------------------------------------------------------------------------|-----------------|----------|-------------------|
| Sales Service |  <pre> graph TD     Info[Info] --&gt; Claim[Claim]     Claim --&gt; FA[Failure analysis]     Claim --&gt; AR[Analysis report]     FA --&gt; CA[Corrective action]     CA --&gt; Tracking[Tracking]         </pre> |       |     |     |                                                                         |                 |          |                   |
| Q.A Activity  | 1. ISO 9001 Maintenance Activities<br>3. Equipment calibration<br>5. Standardization Management                                                                                                                                                                                                     |       |     |     | 2. Process improvement proposal<br>4. Education And Training Activities |                 |          |                   |

### 3.2 Inspection Specification

Inspection Standard : MIL-STD-105E Table Normal Inspection Single Sampling Level II ◦

Equipment : Gauge 、 MIL-STD 、 Powertip Tester 、 Sample ◦

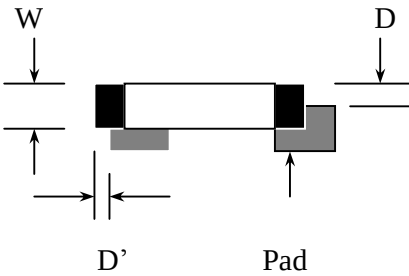
IQC Defect Level : Major Defect AQL 0.4; Minor Defect AQL 1.5 ◦

FQC Defect Level : 100% Inspection ◦

OUT Going Defect Level : Sampling ◦

Specification :

| NO | Item                                                                                          | Specification                                                                                      | Judge | Level |
|----|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------|-------|
| 1  | Part Number                                                                                   | The part number is inconsistent with work order of production                                      | N.G.  | Major |
| 2  | Quantity                                                                                      | The quantity is inconsistent with work order of production                                         | N.G.  | Major |
| 3  | Electronic characteristics of LCM<br>$A = (L + W) \div 2$                                     | The display lacks of some patterns.                                                                | N.G.  | Major |
|    |                                                                                               | Missing line.                                                                                      | N.G.  | Major |
|    |                                                                                               | The size of missing dot, A is $> 1/2$ Dot size                                                     | N.G.  | Major |
|    |                                                                                               | There is no function.                                                                              | N.G.  | Major |
|    |                                                                                               | Output data is error                                                                               | N.G.  | Major |
| 4  | Appearance of LCD<br>$A = (L + W) \div 2$<br><br>Dirty particle (Including scratch 、 bubble ) | Material is different with work order of production                                                | N.G.  | Major |
|    |                                                                                               | LCD is assembled in inverse direction                                                              | N.G.  | Major |
|    |                                                                                               | Bezel is assembled in inverse direction                                                            | N.G.  | Major |
|    |                                                                                               | Shadow is within LCD viewing area + 0.5 mm                                                         | N.G.  | Major |
|    |                                                                                               | The diameter of dirty particle, A is $> 0.4$ mm                                                    | N.G.  | Minor |
|    |                                                                                               | Dirty particle length is $> 3.0$ mm, and $0.01$ mm $<$ width $\leq 0.05$ mm                        | N.G.  | Minor |
|    |                                                                                               | Display is without protective film                                                                 | N.G.  | Minor |
|    |                                                                                               | Conductive rubber is over bezel 1mm                                                                | N.G.  | Minor |
|    |                                                                                               | Polarizer exceeds over viewing area of LCD                                                         | N.G.  | Minor |
|    |                                                                                               | Area of bubble in polarizer, A $> 1.0$ mm, the number of bubble is $> 1$ piece.                    | N.G.  | Minor |
| 5  | Appearance of PCB<br>$A = (L + W) \div 2$                                                     | 0.4mm $<$ Area of bubble in polarizer, A $< 1.0$ mm, the number of bubble is $> 4$ pieces.         | N.G.  | Minor |
|    |                                                                                               | Burned area or wrong part number is on PCB                                                         | N.G.  | Major |
|    |                                                                                               | The symbol, character, and mark of PCB are unidentifiable.                                         | N.G.  | Minor |
|    |                                                                                               | The stripped solder mask , A is $> 1.0$ mm                                                         | N.G.  | Minor |
|    |                                                                                               | 0.3mm $<$ stripped solder mask or visible circuit, A $< 1.0$ mm, and the number is $\geq 4$ pieces | N.G.  | Minor |
|    |                                                                                               | There is particle between the circuits in solder mask                                              | N.G.  | Minor |
|    |                                                                                               | The circuit is peeled off or cracked                                                               | N.G.  | Minor |
|    |                                                                                               | There is any circuits risen or exposed.                                                            | N.G.  | Minor |
|    |                                                                                               | 0.2mm $<$ Area of solder ball, A is $\leq 0.4$ mm                                                  | N.G.  | Minor |
|    |                                                                                               | The number of solder ball is $\geq 3$ pieces                                                       | N.G.  | Minor |
|    |                                                                                               | The magnitude of solder ball, A is $> 0.4$ mm.                                                     | N.G.  | Minor |

| NO | Item                                                           | Specification                                                                                                  | Judge | Level |
|----|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------|-------|
| 6  | Appearance of molding<br>$A = (L + W) \div 2$                  | The shape of modeling is deformed by touching.                                                                 | N.G.  | Major |
|    |                                                                | Insufficient epoxy: Circuit or pad of IC is visible                                                            | N.G.  | Minor |
|    |                                                                | Excessive epoxy: Diameter of modeling is $> 20\text{mm}$ or height is $> 2.5\text{mm}$                         | N.G.  | Minor |
|    |                                                                | The diameter of pinhole in modeling, A is $> 0.2\text{mm}$ .                                                   | N.G.  | Minor |
| 7  | Appearance of frame<br>$A = (L + W) \div 2$                    | The folding angle of frame must be $> 45^\circ + 10^\circ$                                                     | N.G.  | Minor |
|    |                                                                | The area of stripped electroplate in top-view of frame, A is $> 1.0\text{mm}$ .                                | N.G.  | Minor |
|    |                                                                | Rust or crack is (Top view only)                                                                               | N.G.  | Minor |
|    |                                                                | The scratched width of frame is $> 0.06\text{mm}$ . (Top view only)                                            | N.G.  | Minor |
| 8  | Electrical characteristic of backlight<br>$A = (L + W) \div 2$ | The color of backlight is nonconforming                                                                        | N.G.  | Major |
|    |                                                                | Backlight can't work normally.                                                                                 | N.G.  | Major |
|    |                                                                | The LED lamp can't work normally                                                                               | N.G.  | Major |
|    |                                                                | The unsoldering area of pin for backlight, A is $> 1/2$ solder joint area.                                     | N.G.  | Minor |
|    |                                                                | The height of solder pin for backlight is $> 2.0\text{mm}$                                                     | N.G.  | Minor |
| 10 | Assembly parts<br>$A = (L + W) \div 2$                         | The mark or polarity of component is unidentifiable.                                                           | N.G.  | Minor |
|    |                                                                | The height between bottom of component and surface of the PCB is floating $> 0.7\text{mm}$                     | N.G.  | Minor |
|    |                                                                | $D > 1/4W$<br>              | N.G.  | Minor |
|    |                                                                | End solder joint width, D' is $> 50\%$ width of component termination or width of pad                          | N.G.  | Minor |
|    |                                                                | Side overhang, D is $> 25\%$ width of component termination.                                                   | N.G.  | Minor |
|    |                                                                | Component is cracked, deformed, and burned, etc.                                                               | N.G.  | Minor |
|    |                                                                | The polarity of component is placed in inverse direction.                                                      | N.G.  | Minor |
|    |                                                                | Maximum fillet height of solder extends onto the component body or minimum fillet height is $< 0.5\text{mm}$ . | N.G.  | Minor |

## 4. RELIABILITY TEST

### 4.1 Reliability Test Condition

| NO | Item                               | Test Condition                                                                                                                                                                                                                                                                                |                                                                               |
|----|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| 1  | High Temperature Storage           | Storage at 70 $\pm 2^{\circ}\text{C}$ 96~100 hrs<br>Surrounding temperature, then storage at normal condition 4hrs                                                                                                                                                                            |                                                                               |
| 2  | Low Temperature Storage            | Storage at -20 $\pm 2^{\circ}\text{C}$ 96~100 hrs<br>Surrounding temperature, then storage at normal condition 4hrs                                                                                                                                                                           |                                                                               |
| 3  | High Temperature /Humidity Storage | 1.Storage 96~100 hrs 60 $\pm 2^{\circ}\text{C}$ , 90~95%RH surrounding temperature, then storage at normal condition 4hrs.<br>(Excluding the polarizer).<br>or<br>2.Storage 96~100 hrs 40 $\pm 2^{\circ}\text{C}$ , 90~95%RH surrounding temperature, then storage at normal condition 4 hrs. |                                                                               |
| 4  | Temperature Cycling                | $  \begin{array}{c}  -20^{\circ}\text{C} \rightarrow 25^{\circ}\text{C} \rightarrow 70^{\circ}\text{C} \rightarrow 25^{\circ}\text{C} \\  (30\text{mins}) (5\text{mins}) (30\text{mins}) (5\text{mins}) \\  \longleftrightarrow \\  10 \text{ Cycle}  \end{array}  $                          |                                                                               |
| 5  | Vibration                          | 10~55Hz ( 1 minute ) 1.5mm<br>X,Y and Z direction * (each 2hrs)                                                                                                                                                                                                                               |                                                                               |
| 6  | ESD Test                           | Air Discharge:<br>Apply 6 KV with 5 times discharge for each polarity +/-                                                                                                                                                                                                                     | Contact Discharge:<br>Apply 250V with 5 times discharge for each polarity +/- |
|    |                                    | Testing location:<br>Around the face of LCD                                                                                                                                                                                                                                                   | Testing location:<br>1.Apply to bezel.<br>2.Apply to Vdd, Vss.                |
| 7  | Drop Test                          | Packing Weight (Kg)                                                                                                                                                                                                                                                                           | Drop Height (cm)                                                              |
|    |                                    | 0 ~ 45.4                                                                                                                                                                                                                                                                                      | 122                                                                           |
|    |                                    | 45.4 ~ 90.8                                                                                                                                                                                                                                                                                   | 76                                                                            |
|    |                                    | 90.8 ~ 454                                                                                                                                                                                                                                                                                    | 61                                                                            |
|    |                                    | Over 454                                                                                                                                                                                                                                                                                      | 46                                                                            |

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## 5. PRECAUTION RELATING PRODUCT HANDLING

### 5.1 SAFETY

- 5.1.1 If the LCD panel breaks , be careful not to get the liquid crystal to touch your skin.
- 5.1.2 If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.

### 5.2 HANDLING

- 5.2.1 Avoid any strong mechanical shock which can break the glass.
- 5.2.2 Avoid static electricity which can damage the CMOS LSI—When working with the module , be sure to ground your body and any electrical equipment you may be using.
- 5.2.3 Do not remove the panel or frame from the module.
- 5.2.4 The polarizing plate of the display is very fragile. So , please handle it very carefully ,do not touch , push or rub the exposed polarizing with anything harder than an HB pencil lead (glass , tweezers , etc.)
- 5.2.5 Do not wipe the polarizing plate with a dry cloth , as it may easily scratch the surface of plate.
- 5.2.6 Do not touch the display area with bare hands , this will stain the display area.
- 5.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.
- 5.2.8 To control temperature and time of soldering is  $350 \pm 20^{\circ}\text{C}$  and 3-5 sec.
- 5.2.9 To avoid liquid (include organic solvent) stained on LCM .

### 5.3 STORAGE

- 5.3.1 Store the panel or module in a dark place where the temperature is  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$  and the humidity is below 65% RH.
- 5.3.2 Do not place the module near organics solvents or corrosive gases.
- 5.3.3 Do not crush , shake , or jolt the module.

### 5.4 TERMS OF WARRANTY

- 5.4.1 Applicable warrant period  
The period is within thirteen months since the date of shipping out under normal using and storage conditions.
- 5.4.2 Unaccepted responsibility  
This product has been manufactured to your company's specification as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment , we cannot take responsibility if the product is used in nuclear power control equipment , aerospace equipment , fire and security systems or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required.