

# POWERTIP CORPORATION

## SPECIFICATIONS

CUSTOMER : 寶 晟

SAMPLE CODE :

(This Code will be changed while mass production)

MASS PRODUCTION : PC1602LRM-GWB-C-P2  
CODE (VER.0)

Customer Approved

Date:

| Sales Sign | QC Confirmed                                                                        | Checked By          | Designer          |
|------------|-------------------------------------------------------------------------------------|---------------------|-------------------|
|            |  | 熊 明 安<br>2004/07/16 | 黃 霄<br>2004/07/16 |

☒ 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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(#047206)

NO.PT-A-005-4



## RECORDS OF REVISION

| Date       | Rev. | Description      | Note | Page |
|------------|------|------------------|------|------|
| 2004/07/16 | 0    | Revised Contents |      |      |
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Note : For detailed information please refer to IC data sheet : ST7066U,KS0065B

## 1. SPECIFICATIONS

### 1.1 Features

| Item              | Standard Value                              |
|-------------------|---------------------------------------------|
| Display Type      | 16*2 Characters                             |
| LCD Type          | STN Blue Positive Transmissive Normal Temp. |
| Driver Condition  | LCD Module : 1/16 Duty , 1/4 Bias           |
| Viewing Direction | 6 O'clock                                   |
| Backlight         | YG LED B/L                                  |
| Weight            | 37 g                                        |
| Interface         | —                                           |
| Other             | —                                           |

### 1.2 Mechanical Specifications

| Item              | Standard Value                   | Unit |
|-------------------|----------------------------------|------|
| Outline Dimension | 80.0(L) * 36.0(w) * 14.1(H)(Max) | mm   |
| Viewing Area      | 64.5(L) * 13.8(w)                | mm   |
| Active Area       | 57.7(L) * 9.4(w)                 | mm   |
| Dot Size          | 0.55(L) * 0.50(w)                | mm   |
| Dot Pitch         | 0.60(L) * 0.55(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 <sub>DD</sub>  | —            | -0.3                  | 7.0                  | V    |
| LCD Driver Supply Voltage | V <sub>LCD</sub> | —            | V <sub>DD</sub> -10.0 | V <sub>DD</sub> +0.3 | V    |
| Input Voltage             | V <sub>IN</sub>  | —            | -0.3                  | V <sub>DD</sub> +0.3 | V    |
| Operating Temperature     | T <sub>OP</sub>  | Excluded B/L | 0                     | 50                   | °C   |
| Storage Temperature       | T <sub>ST</sub>  | Excluded B/L | -20                   | 70                   | °C   |
| Storage Humidity          | H <sub>D</sub>   | Ta < 40 °C   | -                     | 90                   | %RH  |

## 1.4 DC Electrical Characteristics

$V_{DD} = 5.0 \text{ V} \pm 10\%$ ,  $V_{SS} = 0\text{V}$ ,  $T_a = 25^\circ\text{C}$

| Item                 | Symbol   | Condition                  | Min.         | Typ. | Max.     | Unit |
|----------------------|----------|----------------------------|--------------|------|----------|------|
| Logic Supply Voltage | $V_{DD}$ | —                          | 4.5          | 5.0  | 5.5      | V    |
| “H” Input Voltage    | $V_{IH}$ | —                          | $0.7 V_{DD}$ | -    | $V_{DD}$ | V    |
| “L” Input Voltage    | $V_{IL}$ | —                          | -0.3         | -    | 0.6      | V    |
| “H” Output Voltage   | $V_{OH}$ | $I_{OH} = -0.205\text{mA}$ | 3.9          | -    | $V_{DD}$ | V    |
| “L” Output Voltage   | $V_{OL}$ | $I_{OL} = 1.2\text{mA}$    | -            | -    | 0.4      | V    |
| Supply Current       | $I_{DD}$ | $V_{DD} = 5.0 \text{ V}$   | -            | 1.5  | -        | mA   |
| LCM Driver Voltage   | $V_{OP}$ | $0^\circ\text{C}$          | -            | -    | -        | V    |
|                      |          | $25^\circ\text{C} *1$      | -            | 4.3  | -        |      |
|                      |          | $50^\circ\text{C}$         | -            | -    | -        |      |

Note: \*1. The  $V_{op}$  test point is  $V_{DD} - V_o$ .

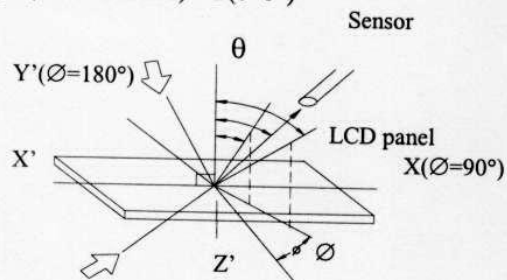
## 1.5 Optical Characteristics

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

| Item                | Symbol   | Conditions                            | Min.       | Typ.   | Max. | Reference   |
|---------------------|----------|---------------------------------------|------------|--------|------|-------------|
| View Angle          | $\theta$ | $C \geq 2.0$ , $\phi = 0^\circ$       | $40^\circ$ | -      | -    | Notes 1 & 2 |
| Contrast Ratio      | C        | $\theta = 5^\circ$ , $\phi = 0^\circ$ | 4          | 6      | -    | Note 3      |
| Response Time(rise) | $t_r$    | $\theta = 5^\circ$ , $\phi = 0^\circ$ | -          | 100 ms | -    | Note 4      |
| Response Time(fall) | $t_f$    | $\theta = 5^\circ$ , $\phi = 0^\circ$ | -          | 110 ms | -    | Note 4      |

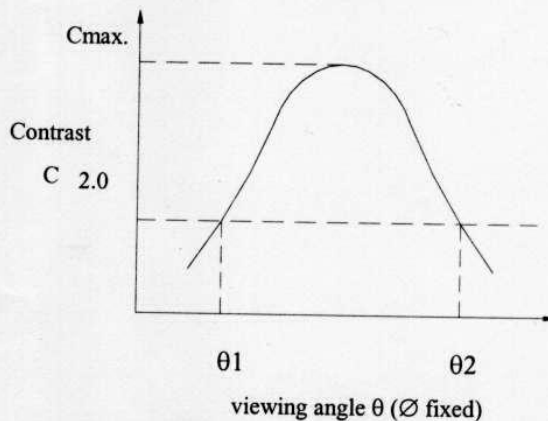
Note 1: Definition of angles  $\theta$  and  $\varnothing$

Light (when reflected)  $z$  ( $\theta=0^\circ$ )



Light (when transmitted)  $Y$  ( $\varnothing=0^\circ$ )  
( $\theta=90^\circ$ )

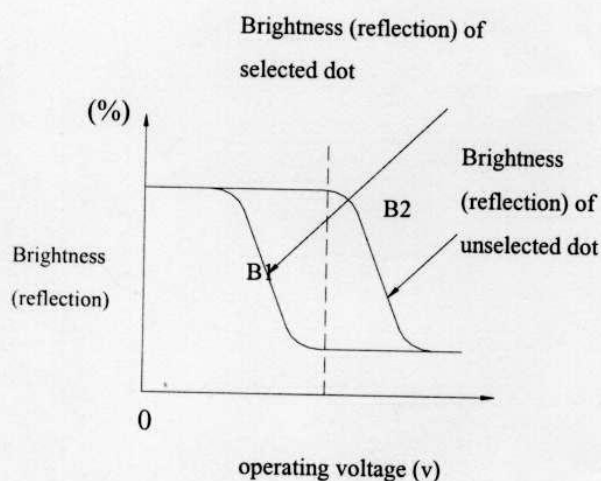
Note 2: Definition of viewing angles  $\theta_1$  and  $\theta_2$



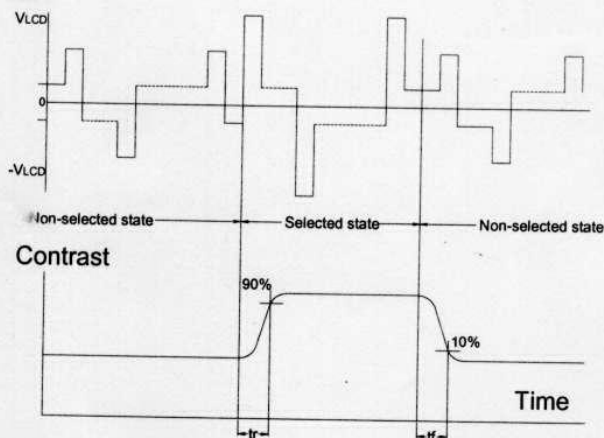
Note: Optimum viewing angle with the naked eye and viewing angle  $\theta$  at  $C_{max}$ . Above are not always the same

Note 3: Definition of contrast  $C$

$$C = \frac{\text{Brightness (reflection) of unselected dot (B2)}}{\text{Brightness (reflection) of selected dot (B1)}}$$



Note 4: Definition of response time



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   | -    | 300  | mA   |
| Reverse Voltage           | VR              | Ta =25°C   | -    | 8    | V    |
| Power Dissipation         | PO              | Ta =25°C   | -    | 1.38 | W    |
| Operating Temperature     | T <sub>OP</sub> | -          | -20  | 70   | °C   |
| Storage Temperature       | T <sub>ST</sub> | -          | -40  | 80   | °C   |
| Solder Temp. for 3 Second | -               | -          | -    | 260  | °C   |

### Electrical / Optical Characteristics

| Ta =25°C                            |              |            |      |      |      |                   |
|-------------------------------------|--------------|------------|------|------|------|-------------------|
| Item                                | Symbol       | Conditions | Min. | Typ. | Max. | Unit              |
| Forward Voltage                     | VF           | IF= 120 mA | -    | 4.2  | 4.6  | V                 |
| Reverse Current                     | IR           | VR= 8 V    | -    | -    | 0.2  | mA                |
| Average Brightness<br>(with LCD)    | IV           | IF= 120 mA | -    | -    | -    | cd/m <sup>2</sup> |
| Wavelength                          | λ p          | IF= 120 mA | 571  | -    | 576  | nm                |
| Luminous Intensity<br>(without LCD) | Iv           | IF=120 mA  | 120  | 150  | -    | cd/m <sup>2</sup> |
| Color                               | Yellow-green |            |      |      |      |                   |

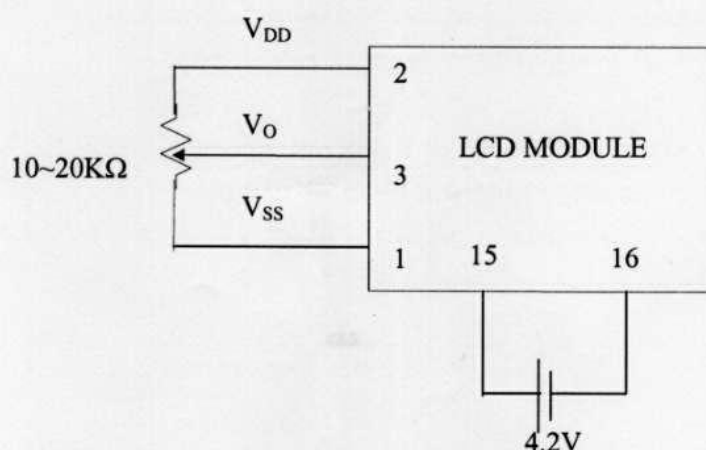




## 2.2 Interface Pin Description

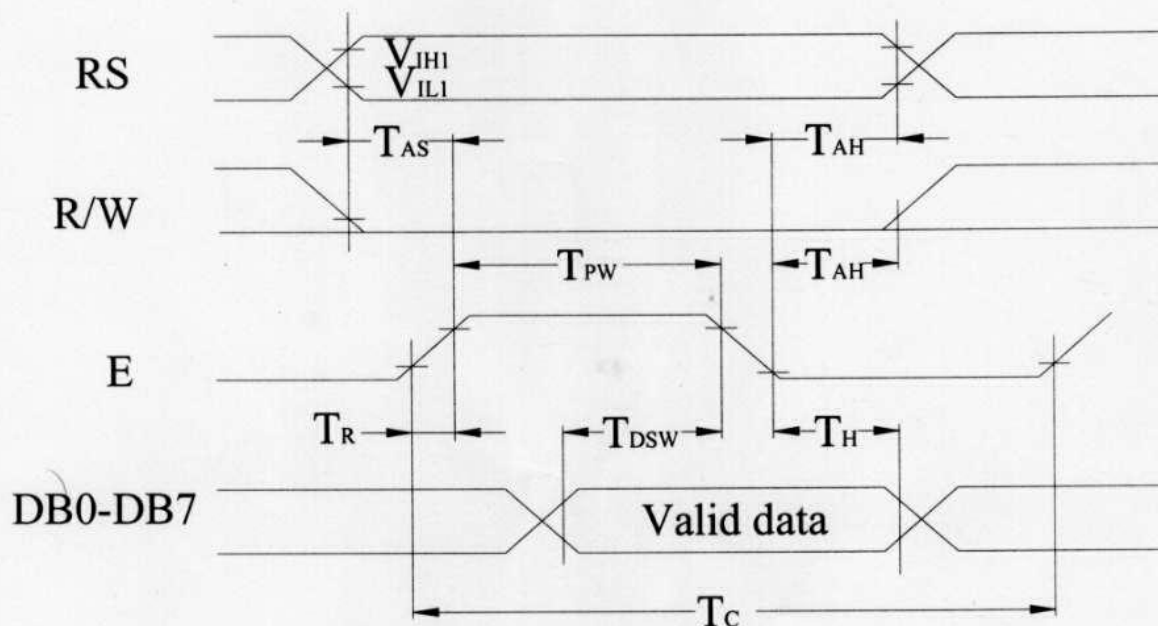
| Pin No. | Symbol           | Signal Description                                                                                                                                                         |
|---------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | VSS              | Power Supply ( $V_{SS}=0$ )                                                                                                                                                |
| 2       | VDD              | Power Supply ( $V_{DD}>V_{SS}$ )                                                                                                                                           |
| 3       | V <sub>O</sub>   | 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

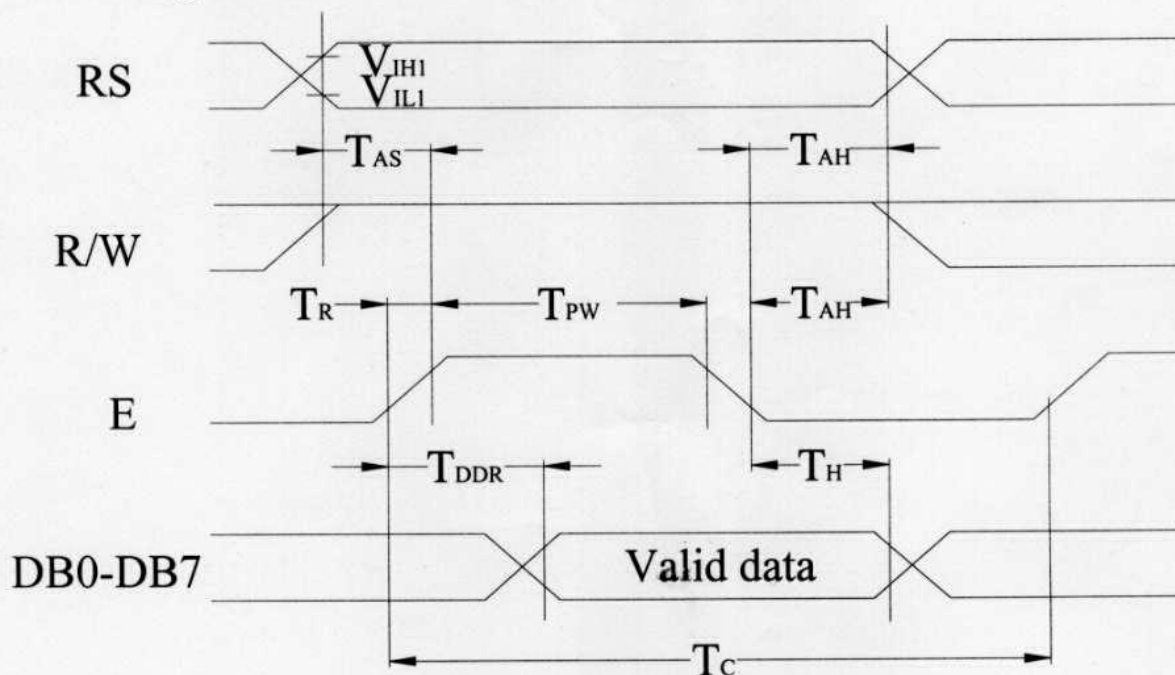


## **2.3 Timing Characteristics**

- Writing data from MPU to ST7066U



- Reading data from ST7066U to MPU



• Write Mode (Writing data from MPU to ST7066U)

(V<sub>cc</sub> = +5V, Ta=25°C)

| Symbol                          | Characteristics         | Test Condition  | Min. | Type | 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)

(V<sub>cc</sub> = +5V, Ta=25°C)

| Symbol                          | Characteristics         | Test Condition  | Min. | Type | 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   |

## 2.4 Display Command

| Instructions            | Instruction Code |     |      |      |      |      |      |      |      |      | Description                                                                                                                       | Description Time<br>(270KHz) |
|-------------------------|------------------|-----|------|------|------|------|------|------|------|------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------|
|                         | RS               | R/W | DB 7 | DB 6 | DB 5 | DB 4 | DB 3 | DB 2 | DB 1 | DB 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 .               | 37 $\mu$ s                   |
| 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                                                            | 37 $\mu$ s                   |
| 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.                               | 37 $\mu$ s                   |
| 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                                           | 37 $\mu$ s                   |
| Set CGRAM Address       | 0                | 0   | 0    | 1    | AC 5 | AC 4 | AC 3 | AC 2 | AC 1 | AC 0 | Set CGRAM address in address counter.                                                                                             | 37 $\mu$ s                   |
| Set DDRAM Address       | 0                | 0   | 1    | AC 6 | AC 5 | AC 4 | AC 3 | AC 2 | AC 1 | AC 0 | Set DDRAM address in address counter.                                                                                             | 37 $\mu$ s                   |

# **POWERTIP**

|                            |   |   |    |      |      |      |      |      |      |      |                                                                                                                        |            |
|----------------------------|---|---|----|------|------|------|------|------|------|------|------------------------------------------------------------------------------------------------------------------------|------------|
| 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.

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



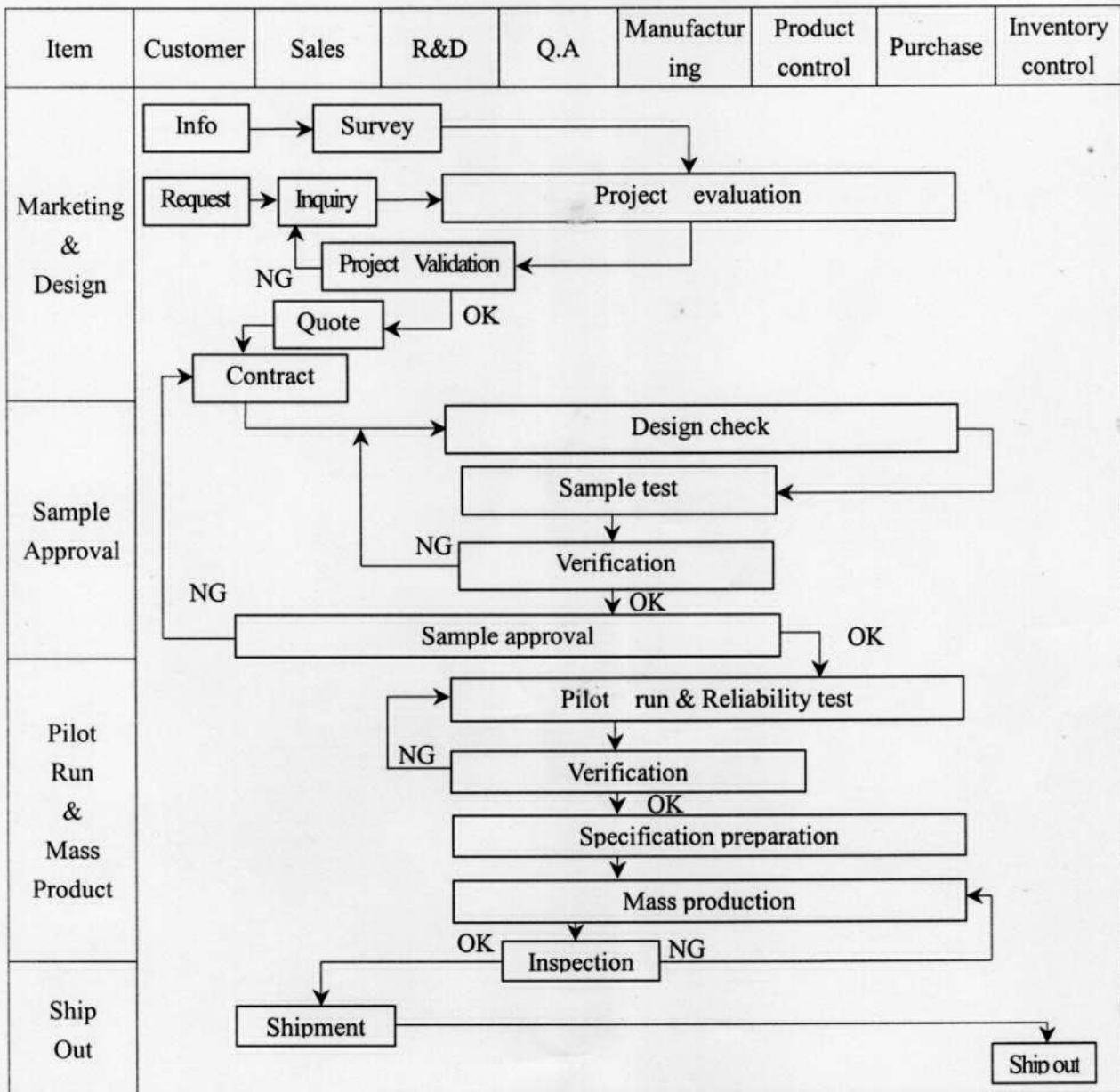
## 2.5 Character Pattern

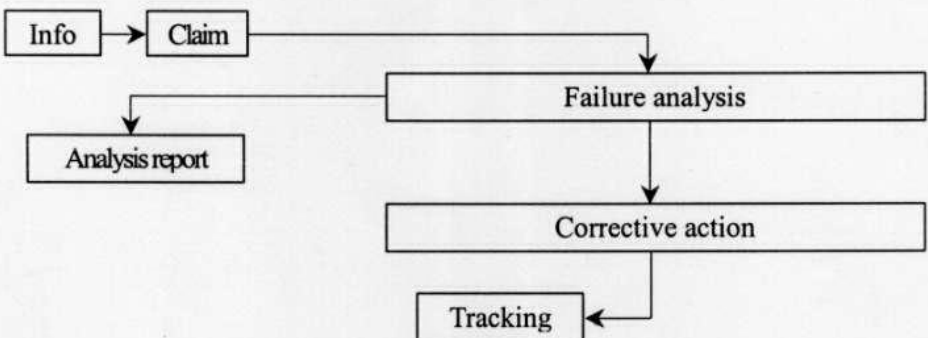
### CHARACTER PATTERN(EB, WB)

|                                                        |   | 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 | 0 | P | ' | P | 5 | E | A | ' | r | 3 | P | 7 |
|                                                        | 1 | CG RAM (2)                                            | ≡ | : | 1 | A | Q | a | 4 | Q | 2 | i | " | J | + | V | U |
|                                                        | 2 | CG RAM (3)                                            | 7 | " | 2 | B | R | b | r | e | F | 6 | ° | o | 5 | 8 | 2 |
|                                                        | 3 | CG RAM (4)                                            | ⌈ | ⊛ | 3 | C | S | c | s | a | a | o | ' | P | W | e | v |
|                                                        | 4 | CG RAM (5)                                            | ⌋ | ⊛ | 4 | D | T | t | t | a | a | e | ' | + | r | 3 | o |
|                                                        | 5 | CG RAM (6)                                            | ⌋ | ⊛ | 5 | E | U | u | u | a | a | e | " | + | Δ | n | 7 |
|                                                        | 6 | CG RAM (7)                                            | ⌋ | ⊛ | 6 | F | V | v | v | a | o | W | " | u | ↓ | 0 | 8 |
|                                                        | 7 | CG RAM (8)                                            | ⌋ | " | 7 | B | W | w | w | S | O | R | x | → | A | L | 4 |
|                                                        | 8 | CG RAM (1)                                            | ⌋ | < | 8 | H | X | x | x | a | o | S | ÷ | + | 3 | K | ⊞ |
|                                                        | 9 | CG RAM (2)                                            | ⌋ | > | 9 | I | Y | y | y | a | S | i | Δ | r | π | λ | 4 |
|                                                        | A | CG RAM (3)                                            | ⊛ | ⊛ | ⊛ | J | Z | z | z | e | O | S | Δ | 7 | 3 | K | ⊞ |
|                                                        | B | CG RAM (4)                                            | ⌋ | + | ⊛ | K | C | k | c | i | R | a | ⊛ | L | 7 | V | ⊛ |
|                                                        | C | CG RAM (5)                                            | ≡ | . | < | L | \ | l | l | a | R | a | ⊛ | ⌋ | ⊛ | 3 | O |
|                                                        | D | CG RAM (6)                                            | ⌋ | — | ≡ | M | I | m | i | a | S | ⊛ | " | W | π | — | — |
|                                                        | E | CG RAM (7)                                            | ⊛ | . | > | N | ^ | n | ^ | A | S | ⊛ | 7 | 0 | P | P | ⊛ |
|                                                        | F | CG RAM (8)                                            | ⊛ | / | ? | O | _ | o | Δ | Δ | Δ | o | — | 0 | o | o | ⊛ |

### 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]     FA --&gt; CA[Corrective action]     CA --&gt; Tracking[Tracking]     Info --&gt; AR[Analysis report] </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 °

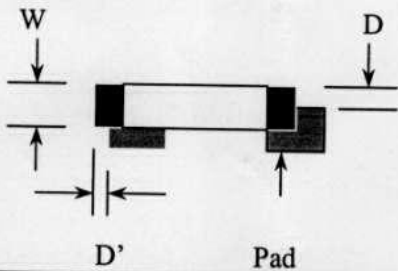
IQC Defect Level : Major Defect AQL 0.4; Minor Defect AQL 1.5 °

FQC Defect Level : 100% Inspection °

OUT Going Defect Level : Sampling °

Specification :

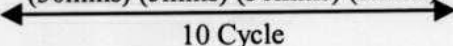
| NO | Item                                                      | Specification                                                                                         | Judge | Level |
|----|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------|-------|
| 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>$A = (L + W) \div 2$                 | 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 (Including scratch 、bubble )               | 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 |
|    |                                                           | $0.4$ mm $<$ Area of bubble in polarizer, A $< 1.0$ mm, the number of bubble is $> 4$ pieces.         | N.G   | Minor |
| 5  | Appearance of PCB<br>$A = (L + W) \div 2$                 | 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 |
|    |                                                           | $0.3$ mm $<$ 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 |
|    |                                                           | $0.2$ mm $<$ 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 $80 \pm 2^{\circ}\text{C}$ 96~100 hrs<br>Surrounding temperature, then storage at normal condition 4hrs                                                                                                                                                                                                                                     |                                                                               |
| 2  | Low Temperature Storage            | Storage at $-30 \pm 2^{\circ}\text{C}$ 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                | $-20^{\circ}\text{C} \rightarrow 25^{\circ}\text{C} \rightarrow 70^{\circ}\text{C} \rightarrow 25^{\circ}\text{C}$<br>$(30\text{mins}) (5\text{mins}) (30\text{mins}) (5\text{mins})$<br><div style="text-align: center;"> <br/>           10 Cycle         </div> |                                                                               |
| 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                                                                            |





## **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  $280 \pm 10^{\circ}\text{C}$  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.