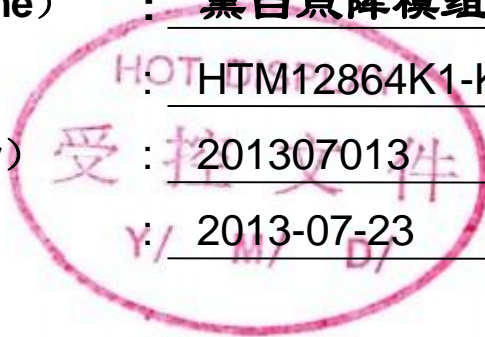




# HTM12864K1-K-31W-30C05

产品名称 (Product name) : 黑白点阵模组  
 型号 (Model) : HTM12864K1-K-31W  
 编号 (Part number) : 201307013  
 日期 (Date) : 2013-07-23



深圳市鑫洪泰电子科技有限公司  
 Shenzhen Hot Display Technology Co.,Ltd

|                   |                  |                   |
|-------------------|------------------|-------------------|
| 编制<br>Prepared by | 审核<br>Checked by | 核准<br>Approved by |
|                   |                  |                   |

编码: QR-R-011 A/0

序号:

| Rev. | Descriptions      | Date       |
|------|-------------------|------------|
| 01   | Prelimiay Release | 2014-07-23 |
|      |                   |            |
|      |                   |            |

# Table of Content

|                                           |       |           |
|-------------------------------------------|-------|-----------|
| <b>1. Bsaic Specifications</b>            | ----- | <b>3</b>  |
| 1.1 Display Specifications                | ----- | 3         |
| 1.2 Mechanical Specifications             | ----- | 3         |
| 1.3 Circuit Diagram                       | ----- | 3         |
| 1.4 Terminal Function                     | ----- | 4         |
| 1.5 Product Outline                       | ----- | 5         |
| 1.6 Schematic Diagram                     | ----- | 6         |
| <b>2. Absolute Maximum Ratings</b>        | ----- | <b>7</b>  |
| <b>3. Electrical Characteristics</b>      | ----- | <b>7</b>  |
| 3.1 DC Characteristics                    | ----- | 7         |
| 3.2 LED Backlight Circuit                 | ----- | 7         |
| 3.3 AC Characteristics                    | ----- | 8         |
| 3.4 Reset Timing                          | ----- | 9         |
| <b>4. Function specifications</b>         | ----- | <b>9</b>  |
| 4.1 The Parallel Interface                | ----- | 9         |
| 4.2 Basic Setting                         | ----- | 10        |
| 4.3 Resetting the LCD module              | ----- | 10        |
| 4.4 Display Memory Map                    | ----- | 10        |
| 4.5 Display Commands                      | ----- | 11        |
| 4.6 Basic Operating Sequence              | ----- | 12        |
| <b>5. Inspection Standards</b>            | ----- | <b>13</b> |
| <b>6. Handling Precautions</b>            | ----- | <b>14</b> |
| 6.1 Mounting method                       | ----- | 14        |
| 6.2 Cautions of LCD handling and cleaning | ----- | 14        |
| 6.3 Caution against static charge         | ----- | 14        |
| 6.4 Packaging                             | ----- | 14        |
| 6.5 Caution for operation                 | ----- | 14        |
| 6.6 Storage                               | ----- | 14        |
| 6.7 Safety                                | ----- | 14        |
| <b>7 Packaging specifications</b>         | ----- | <b>15</b> |

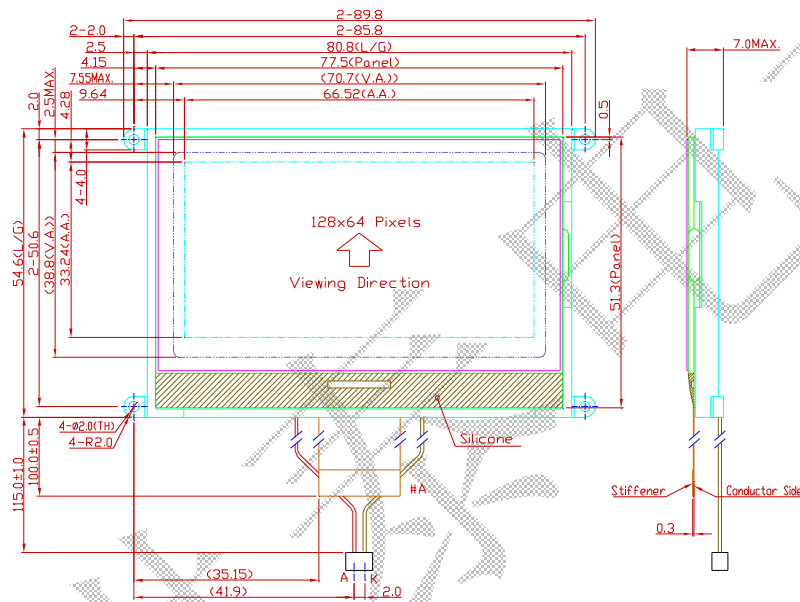
# 1. Basic Specifications

## 1.1 Display Specifications

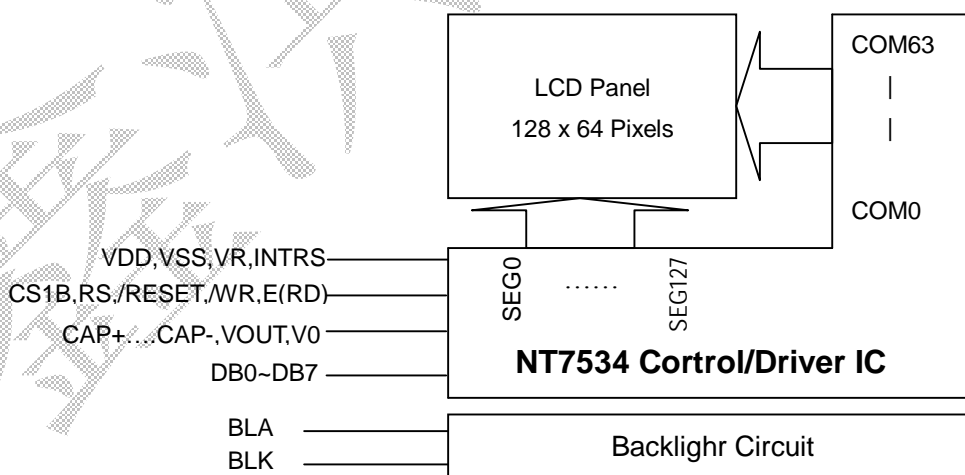
- 1>LCD Display Mode : FSTN, Positive, Transflective
- 2>Viewing Angle : 6H
- 3>Driving Method : 1/65 Duty, 1/9 Bias
- 4>Backlight : White Led

## 1.2 Mechanical Specifications

- 1>Outline Dimension : 89.8 x54.6 x 7.0mm (See attached Outline Drawing for Details)



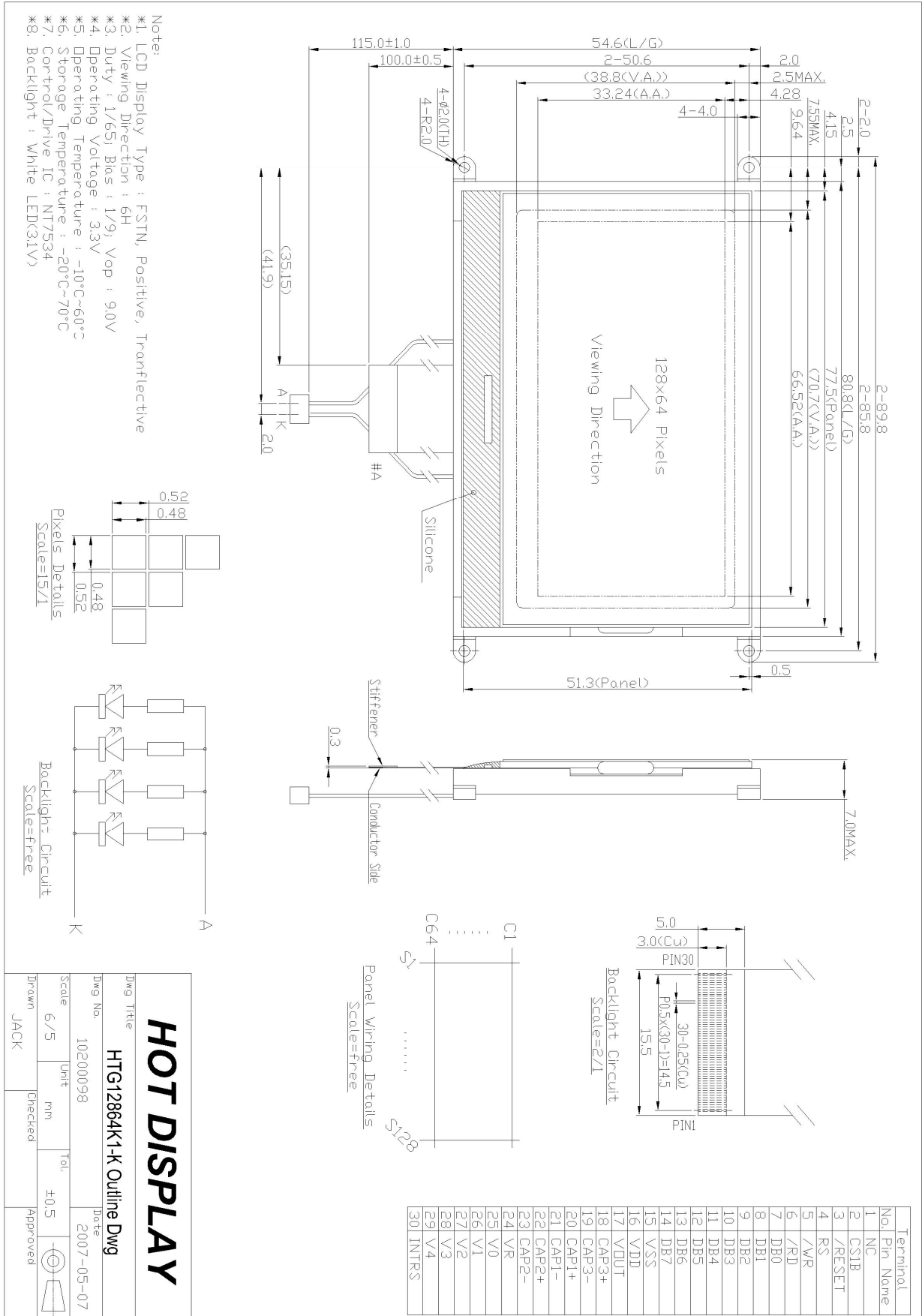
## 1.3 Circuit Diagram



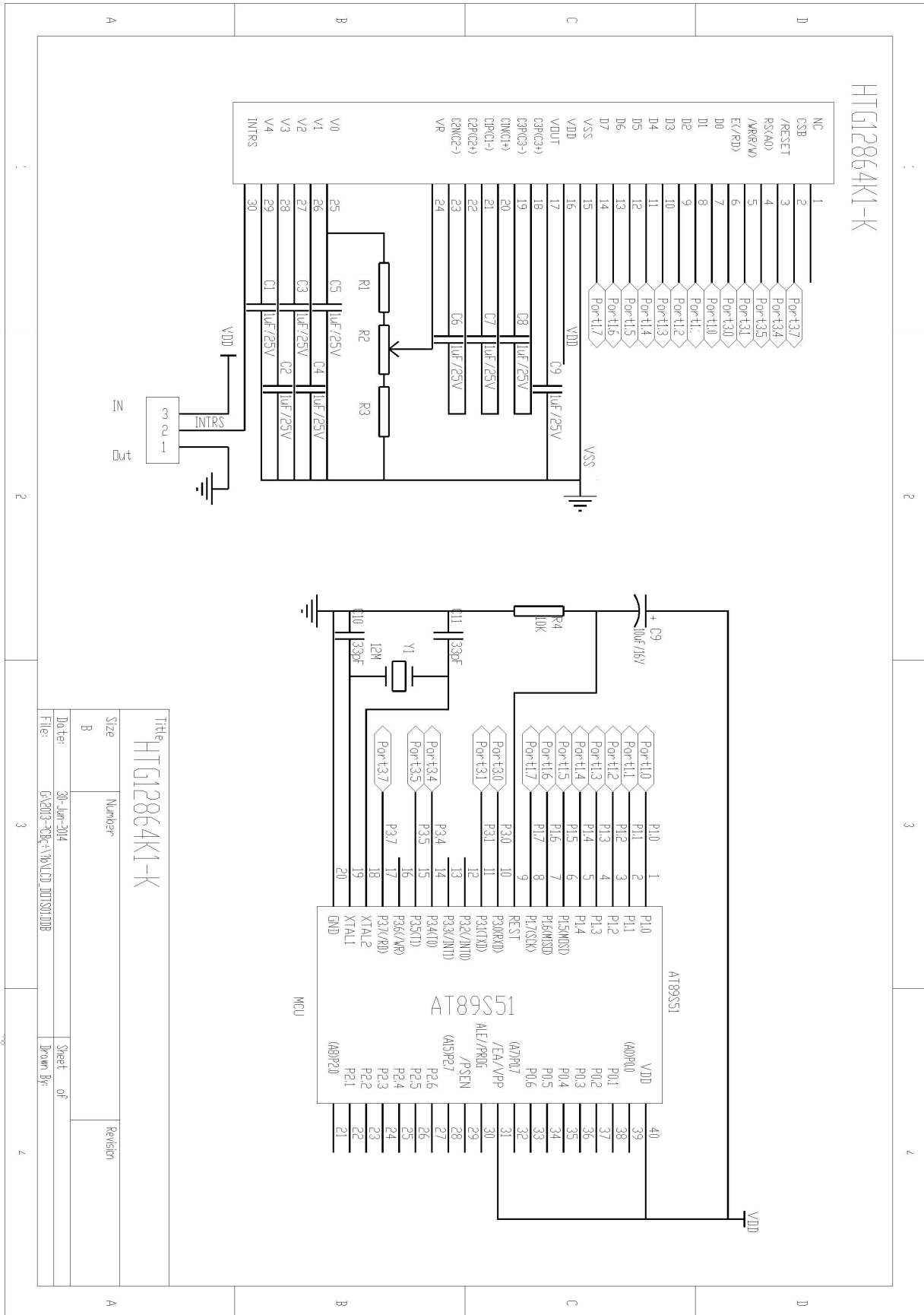
### 1.4 Terminal Function

| Pin No. | Pin Name | Function                                                                                                                                                                                                                                                                                             |
|---------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | NC       | No Connection, Leave Open                                                                                                                                                                                                                                                                            |
| 2       | CS1B     | Chip Enable input                                                                                                                                                                                                                                                                                    |
| 3       | /RESET   | When /RES is set to "L", the register settings are initialized (cleared)                                                                                                                                                                                                                             |
| 4       | RS       | Data/Command control.                                                                                                                                                                                                                                                                                |
| 5       | /WR(R/W) | When R/W = "H": Read.<br>When R/W = "L": Write.                                                                                                                                                                                                                                                      |
| 6       | /RD(E)   | The Enable Clock Input                                                                                                                                                                                                                                                                               |
| 7~14    | DB0~DB7  | 8-bit Data bus                                                                                                                                                                                                                                                                                       |
| 15      | VSS      | Power supply,( Ground 0V)                                                                                                                                                                                                                                                                            |
| 16      | VDD      | Power supply(3.3V)                                                                                                                                                                                                                                                                                   |
| 17      | VOOUT    | Voltage converter input / output pin,Connect this pin to Vss through capacitor.                                                                                                                                                                                                                      |
| 18      | CAP3+    | Capacitor 3 positive connection pin for voltage converter                                                                                                                                                                                                                                            |
| 19      | CAP3-    | Capacitor 3 negative connection pin for voltage converter                                                                                                                                                                                                                                            |
| 20      | CAP1+    | Capacitor 1 positive connection pin for voltage converter                                                                                                                                                                                                                                            |
| 21      | CAP1-    | Capacitor 1 negative connection pin for voltage converter                                                                                                                                                                                                                                            |
| 22      | CAP2+    | Capacitor 2 positive connection pin for voltage converter                                                                                                                                                                                                                                            |
| 23      | CAP2-    | Capacitor 2 negative connection pin for voltage converter                                                                                                                                                                                                                                            |
| 24      | VR       | V0 voltage adjustment pin,It is valid only when internal voltage regulator resistors are not used (INTRS = "L").                                                                                                                                                                                     |
| 25      | V0       | LCD driver supply voltage                                                                                                                                                                                                                                                                            |
| 26      | V1       | LCD driver supply voltage                                                                                                                                                                                                                                                                            |
| 27      | V2       | LCD driver supply voltage                                                                                                                                                                                                                                                                            |
| 28      | V3       | LCD driver supply voltage                                                                                                                                                                                                                                                                            |
| 29      | V4       | LCD driver supply voltage                                                                                                                                                                                                                                                                            |
| 30      | INTRS    | Internal resistor select pin<br>This pin selects the resistors for adjusting V0 voltage level and is valid only in master operation.<br>– INTRS = "H": use the internal resistors<br>– INTRS = "L": use the external resistors<br>V0 voltage is controlled by VR pin and external resistive divider. |

1.5 Product Outline



1.6 Schematic Diagram



|       |                              |              |    |
|-------|------------------------------|--------------|----|
| Title |                              | HTG12864K1-K |    |
| Size  | Number                       | Revision     |    |
| B     |                              |              |    |
| Date: | 30-Jun-2014                  | Sheet        | of |
| File: | G:\2013-2014\HOTLCD\DOTS\JOB | Drawn By:    |    |

## 2. Absolute Maximum Ratings

| Items                 | Symbol          | MIN. | MAX.                 | Unit | Condition            |
|-----------------------|-----------------|------|----------------------|------|----------------------|
| Supply Voltage        | V <sub>DD</sub> | -0.3 | +3.6                 | V    | V <sub>SS</sub> = 0V |
| Input Voltage         | V <sub>IN</sub> | -0.3 | V <sub>DD</sub> +0.3 | V    | V <sub>SS</sub> = 0V |
| Operating Temperature | T <sub>OP</sub> | -10  | +60                  | °C   | No Condensation      |
| Storage Temperature   | T <sub>st</sub> | -20  | +70                  | °C   | No Condensation      |

## 3. Electrical Characteristics

### 3.1 DC Characteristics

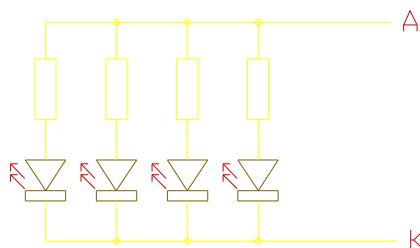
V<sub>SS</sub> = 0V, T<sub>OP</sub> = 25°C

| Items                  | Symbol           | MIN.                  | TYP. | MAX.                  | Unit | Condition                   |
|------------------------|------------------|-----------------------|------|-----------------------|------|-----------------------------|
| Operating Voltage      | V <sub>DD</sub>  | 2.4                   | 3.3  | 3.6                   | V    | -                           |
| Booster Voltage        | V <sub>out</sub> | 6.0                   | -    | 14.0                  | V    | -                           |
| Input High Voltage     | V <sub>IH</sub>  | 0.8 x V <sub>DD</sub> | -    | V <sub>DD</sub>       | V    | /CS1,/RES,A0                |
| Input Low Voltage      | V <sub>IL</sub>  | V <sub>SS</sub>       | -    | 0.2 x V <sub>DD</sub> | V    | SCK,SDI                     |
| Output High Voltage    | V <sub>OH</sub>  | 0.8 x V <sub>DD</sub> | -    | V <sub>DD</sub>       | V    | -                           |
| Output Low Voltage     | V <sub>OL</sub>  | V <sub>SS</sub>       | -    | 0.2 x V <sub>DD</sub> | V    | -                           |
| Input Leakage Current  | I <sub>LI</sub>  | -1.0                  | -    | 1.0                   | μA   | -                           |
| Output Leakage Current | I <sub>Lo</sub>  | -3.0                  | -    | 3.0                   | μA   | -                           |
| Operation Current      | I <sub>OP</sub>  | -                     | 100  | 210                   | μA   | V <sub>OUT</sub> =6.0~13.5V |
| Standby Mode           | I <sub>DD</sub>  | -                     | 4    | 10                    | μA   | T <sub>a</sub> = 25°C       |
| Sleep Mode             | I <sub>SL</sub>  | -                     | 0.01 | 5                     | μA   | Display OFF                 |

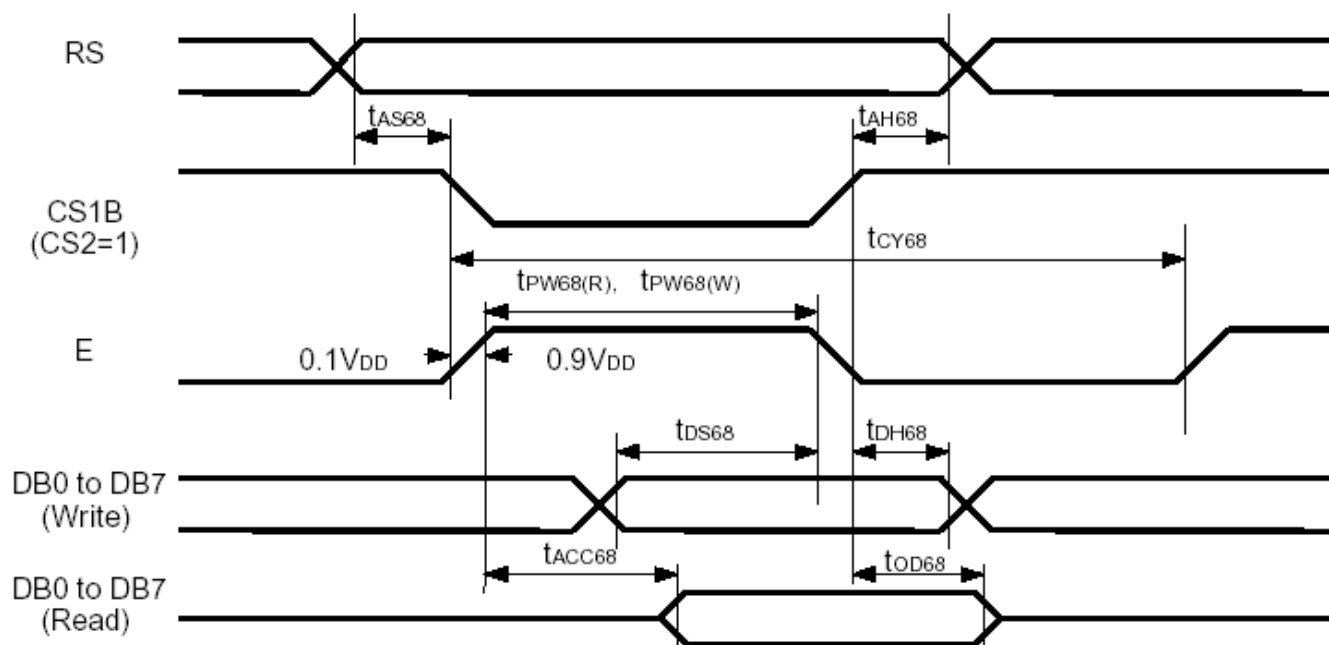
### 3.2 LED Backlight Circuit

V<sub>SS</sub> = 0V, T<sub>OP</sub> = 25°C

| Items           | Symbol             | MIN. | TYP. | MAX. | Unit | Condition |
|-----------------|--------------------|------|------|------|------|-----------|
| Forward Voltage | V <sub>f</sub> BLA | -    | 3.3  | -    | V    | -         |
| Forward Current | I <sub>f</sub> BLA | -    | 60   | 80   | mA   | -         |



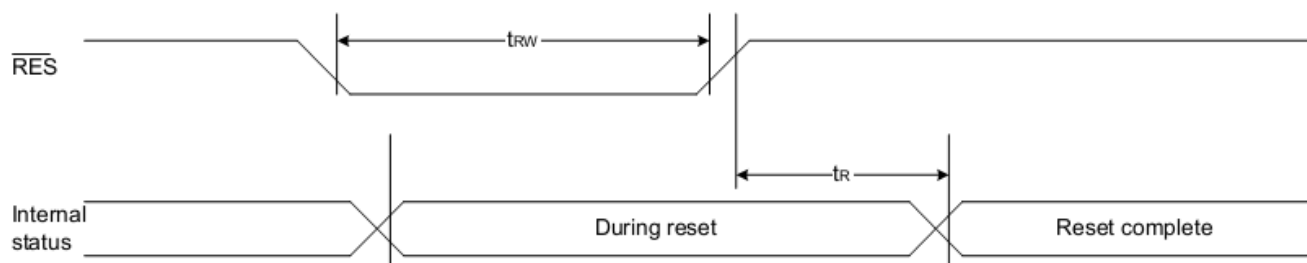
### 3.3 AC Characteristics(6800 Mode System Bus Time)



| Items                        | Symbol | MIN. | TYP. | MAX. | Unit | Condition |
|------------------------------|--------|------|------|------|------|-----------|
| System cycle time            | Tcyc6  | 240  | -    | -    | ns   | -         |
| Address setup time(A0)       | Taw6   | 0    | -    | -    | ns   | -         |
| Address hold time(A0)        | Tah6   | 0    | -    | -    | ns   | -         |
| Control High Pulse wide(/RD) | tcchr  | 120  | -    | -    | ns   | /WR,/RD   |
| Control High Pulse wide(/WR) | tcchw  | 100  | -    | -    | ns   | /WR,/RD   |
| Data steup time              | Tds6   | 40   | -    | -    | ns   | DB0-DB7   |
| Data hold time               | Tdh6   | 10   | -    | -    | ns   | DB0-DB7   |
| /RD access time(*a)          | Tacc6  | -    | -    | 140  | ns   | DB0-DB7   |
| Output disable time(*a)      | Tch6   | 10   | -    | 50   | ns   | CL=100pF  |



### 3.4 Reset Timing



(VDD = 3.3V, Ta = -30 to 85°C)

| Item                  | Signal | Symbol | Condition | Rating |      |      | Units |
|-----------------------|--------|--------|-----------|--------|------|------|-------|
|                       |        |        |           | Min.   | Typ. | Max. |       |
| Reset time            |        | tR     |           | —      | —    | 1.0  | us    |
| Reset "L" pulse width | /RES   | tRW    |           | 1.0    | —    | —    | us    |

Table 37

(VDD = 2.7V, Ta = -30 to 85°C)

| Item                  | Signal | Symbol | Condition | Rating |      |      | Units |
|-----------------------|--------|--------|-----------|--------|------|------|-------|
|                       |        |        |           | Min.   | Typ. | Max. |       |
| Reset time            |        | tR     |           | —      | —    | 2.0  | us    |
| Reset "L" pulse width | /RES   | tRW    |           | 2.0    | —    | —    | us    |

Table 38

(VDD = 1.8V, Ta = -30 to 85°C)

| Item                  | Signal | Symbol | Condition | Rating |      |      | Units |
|-----------------------|--------|--------|-----------|--------|------|------|-------|
|                       |        |        |           | Min.   | Typ. | Max. |       |
| Reset time            |        | tR     |           | —      | —    | 3.0  | us    |
| Reset "L" pulse width | /RES   | tRW    |           | 3.0    | —    | —    | us    |

**Note:**

\*a. all timing is using 20% and 80% of VDD as the reference.

## 4. Function specifications

### 4.1 The 4Line SPI Interface Signal Chart

| Shared | 6800 Mode |        | Function                |
|--------|-----------|--------|-------------------------|
| A0     | R/W       | E(/RD) |                         |
| H      | H         | H      | Reads the display data  |
| H      | L         | HàL    | Writes the display data |
| L      | H         | H      | Status read             |
| L      | L         | HàL    | Write Command data      |

### 4.2 Basic Setting

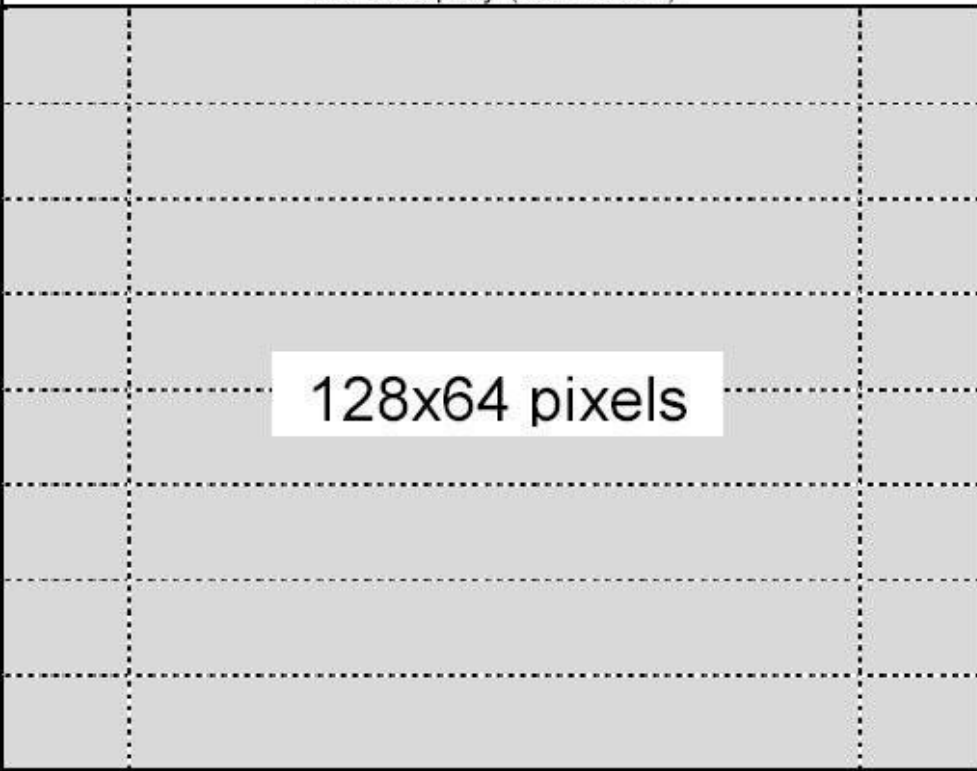
To drive the LCD module correctly and provide normally display, please use the following setting

- 1> ADC = 0 (normal)
- 2> SHL select = 1(reverse)
- 3> LCD Bias Select = 1/9
- 4> Initial Display Line = 0
- 5> Entire Display ON/OFF = OFF(normal)
- 6> Reverse Display ON/OFF = OFF(normal)
- 7> Set Power Control Set:  
Voltage follower = ON,voltage converter = ON,Voltage regulator = ON
- 8> Display ON/OFF =ON

### 4.3 Resetting the LCD module

The LCD module should be initialized bu using /RES terminal.  
While turning on the VDD and VSS power supply, maintain /RES terminal at LOW level, After the Power supply stabilized, release the reset terminal(/RES = High)

### 4.4 Display Memory Map

| Page address   | data          | LCD Display (front view)                                                                                                                               |       |
|----------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 0              | D0<br>:<br>D7 |  <p style="text-align: center; font-size: 24px;">128x64 pixels</p> |       |
| 1              | D0<br>:<br>D7 |                                                                                                                                                        |       |
| 2              | D0<br>:<br>D7 |                                                                                                                                                        |       |
| 3              | D0<br>:<br>D7 |                                                                                                                                                        |       |
| 4              | D0<br>:<br>D7 |                                                                                                                                                        |       |
| 5              | D0<br>:<br>D7 |                                                                                                                                                        |       |
| 6              | D0<br>:<br>D7 |                                                                                                                                                        |       |
| 7              | D0<br>:<br>D7 |                                                                                                                                                        |       |
| Column Address |               | 00h                                                                                                                                                    | → 7Fh |

## 4.5 Display Commands

| No. | Instrctions                       | Code |     |     |            |    |                          |    |              |       |    |    | Function                                       |                                                                                                                                                                         |
|-----|-----------------------------------|------|-----|-----|------------|----|--------------------------|----|--------------|-------|----|----|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                                   | A0   | /RD | /WR | D7         | D6 | D5                       | D4 | D3           | D2    | D1 | D0 |                                                |                                                                                                                                                                         |
| 1   | Display ON/OFF                    | 0    | 1   | 0   | 1          | 0  | 1                        | 0  | 1            | 1     | 1  | 1  | DON                                            | DON=0,display off<br>DON=1,display on                                                                                                                                   |
| 2   | Display start line set            | 0    | 1   | 0   | 0          | 1  | Display start address    |    |              |       |    |    | Set the display RAM display start line address |                                                                                                                                                                         |
| 3   | Set Page Address                  | 0    | 1   | 0   | 1          | 0  | 1                        | 1  | Page address |       |    |    |                                                | Set the display RAM Page address                                                                                                                                        |
| 4   | Ser Column Address (Upper-4 bits) | 0    | 1   | 0   | 0          | 0  | 0                        | 1  | Col. Add     |       |    |    |                                                | Set the upper-4-bit of column address counter                                                                                                                           |
|     | Ser Column Address (Lower-4 bits) | 0    | 1   | 0   | 0          | 0  | 0                        | 0  | Col. Add     |       |    |    |                                                | Set the low-4-bit of column address counter                                                                                                                             |
| 5   | Read Staus                        | 0    | 0   | 1   | Status     |    |                          |    | 0            | 0     | 0  | 0  |                                                | Read the status data                                                                                                                                                    |
| 6   | Write Display Data                | 1    | 1   | 0   | Write Data |    |                          |    |              |       |    |    | Write data into the display RAM                |                                                                                                                                                                         |
| 7   | Read Display Data                 | 1    | 0   | 1   | Read Data  |    |                          |    |              |       |    |    | Read data from the display RAM                 |                                                                                                                                                                         |
| 8   | ADC Select                        | 0    | 1   | 0   | 1          | 0  | 1                        | 0  | 0            | 0     | 0  | 0  | ADC                                            | Set the display RAM address SEG output Correspondence<br>ADC = 0,Normal. ADC = 1,Reverse                                                                                |
| 9   | Normal/Reverse Display            | 0    | 1   | 0   | 1          | 0  | 1                        | 0  | 0            | 1     | 1  |    | REV                                            | REV = 0, Normal<br>REV = 1, Reverse                                                                                                                                     |
| 10  | Entire Display ON/OFF             | 0    | 1   | 0   | 1          | 0  | 1                        | 0  | 0            | 1     | 0  |    | EON                                            | EON = 0, Normal<br>EON = 1, Entire display ON                                                                                                                           |
| 11  | Set LCD Bias                      | 0    | 1   | 0   | 1          | 0  | 1                        | 0  | 0            | 0     | 1  |    | BIAS                                           | Bias = 0, 1/9 Bias<br>Bias = 1, 1/7 Bias                                                                                                                                |
| 12  | Set Read-Modify-Write             | 0    | 1   | 0   | 1          | 1  | 1                        | 0  | 0            | 0     | 0  | 0  |                                                | Enter the "Read-Modify-Write" mode                                                                                                                                      |
| 13  | Reset Read-Modify-Write           | 0    | 1   | 0   | 1          | 1  | 1                        | 0  | 1            | 1     | 1  | 0  |                                                | Clear the "Read-Modify-Write" mode                                                                                                                                      |
| 14  | Reset                             | 0    | 1   | 0   | 1          | 1  | 1                        | 0  | 0            | 0     | 1  | 0  |                                                | Resets the LCD module                                                                                                                                                   |
| 15  | SHL S elect                       | 0    | 1   | 0   | 1          | 1  | 0                        | 0  | SHL          | *     | *  | *  |                                                | Set the COM scanning direction<br>SHL = 0, Normal<br>SHL = 1, Flipped in y-direction<br>* = don't care terms                                                            |
| 16  | Power Control Set                 | 0    | 1   | 0   | 0          | 0  | 1                        | 0  | 1            | VC    | VR | VF |                                                | Set the power circuit operation mode<br>VF : LCD Supply Voltage Follower<br>VR : LCD Supply Voltage Regulator<br>VF : LCD Supply Voltage Converter<br>(1 = ON, 0 = OFF) |
| 17  | Regulator Resistor Select         | 0    | 1   | 0   | 0          | 0  | 1                        | 0  | 0            | Ratio |    |    |                                                | Set the built-in resistor ratio (Rb/Ra)                                                                                                                                 |
| 18  | Electronic volume mode set        | 0    | 1   | 0   | 1          | 0  | 0                        | 0  | 0            | 0     | 0  | 1  |                                                | Set reference voltage mode                                                                                                                                              |
|     | Electronic volume register set    | 0    | 1   | 0   | *          | *  | Electronic Control value |    |              |       |    |    | Set reference voltage register                 |                                                                                                                                                                         |
| 19  | Power Save                        |      | -   | -   | -          | -  | -                        | -  | -            | -     | -  | -  |                                                | Compound instruction<br>Display OFF + Entire Display ON                                                                                                                 |
| 20  | NOP                               | 0    | 1   | 0   | 1          | 1  | 1                        | 0  | 0            | 0     | 1  | 1  |                                                | Non-operation command                                                                                                                                                   |

**Note:**

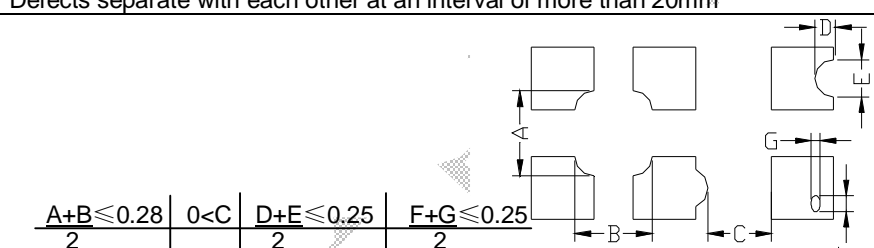
\*a. For the details of the Display Commands, please refer to NT7534 data sheet

### 4.6 Basic Operating Sequence

#### Initialization Sequence

|                                                                                                            | Code Function |              |    |    |    |    |    |    |    |     | Note |                                                                                           |
|------------------------------------------------------------------------------------------------------------|---------------|--------------|----|----|----|----|----|----|----|-----|------|-------------------------------------------------------------------------------------------|
|                                                                                                            | A0            | D7           | D6 | D5 | D4 | D3 | D2 | D1 | D0 | hex |      |                                                                                           |
| Turn on Power Supply VDD & VSS While maintaining /RES at LOW                                               | -             | -            | -  | -  | -  | -  | -  | -  | -  | -   | -    |                                                                                           |
| Wait until power supply is stabilized                                                                      | -             | -            | -  | -  | -  | -  | -  | -  | -  | -   | -    |                                                                                           |
| Release the /RES Reset Signal (/RES = High)                                                                | -             | -            | -  | -  | -  | -  | -  | -  | -  | -   | -    | See AC Characteristics section for timing details                                         |
| LCD Bias = 1/9                                                                                             | 0             | 1            | 0  | 1  | 0  | 0  | 0  | 1  | 0  |     | A2H  | LCD Characteristics                                                                       |
| ADC = Normal                                                                                               | 0             | 1            | 0  | 1  | 0  | 0  | 0  | 0  | 0  |     | A0H  | No flip on x-direction (SEG)                                                              |
| SHL = Reverse                                                                                              | 0             | 1            | 1  | 0  | 0  | 1  | 0  | 0  | 0  |     | C8H  | Flip on y- direction (COM)                                                                |
| Initial Display Line = 0                                                                                   | 0             | 0            | 1  | 0  | 0  | 0  | 0  | 0  | 0  |     | 40H  | i.e. Display RAM "Page 0-D0" Matched to top line of the LCD                               |
| Power Control<br>Voltage Follower = OFF<br>Voltage Regulator = OFF<br>Voltage Converter = ON<br>Delay 50ms | 0             | 0            | 0  | 1  | 0  | 1  | 1  | 0  | 0  |     | 2CH  | Turn on the internal Voltage Converter and wait until VOUT stable                         |
|                                                                                                            | -             | -            | -  | -  | -  | -  | -  | -  | -  | -   | -    |                                                                                           |
| Power Control<br>Voltage Follower = OFF<br>Voltage Regulator = OFF<br>Voltage Converter = ON<br>Delay 50ms | 0             | 0            | 0  | 1  | 0  | 1  | 1  | 1  | 0  |     | 2EH  | Turn on the internal Voltage Regulator and wait until VOUT stable                         |
|                                                                                                            | -             | -            | -  | -  | -  | -  | -  | -  | -  | -   | -    |                                                                                           |
| Power Control<br>Voltage Follower = OFF<br>Voltage Regulator = OFF<br>Voltage Converter = ON<br>Delay 50ms | 0             | 0            | 0  | 1  | 0  | 1  | 1  | 1  | 1  |     | 2FH  | Turn on the internal Voltage Follower and wait until VOUT stable                          |
|                                                                                                            | -             | -            | -  | -  | -  | -  | -  | -  | -  | -   | -    |                                                                                           |
| Regulator Resistor Select                                                                                  | 0             | 0            | 0  | 1  | 0  | 0  | 1  | 0  | 1  |     | 25H  | Set the built-in resistor ratio to middle                                                 |
| Set Reference Voltage Mode<br>Set Reference Voltage Resistor                                               | 0             | 1            | 0  | 0  | 0  | 0  | 0  | 0  | 1  |     | 81H  | Set to the middle of the range it may be adjusted For achieving the best display contrast |
|                                                                                                            | 0             | 0            | 0  | 1  | 0  | 0  | 0  | 1  | 0  |     | 22H  |                                                                                           |
| Display ON                                                                                                 | 0             | 1            | 0  | 1  | 0  | 1  | 1  | 1  | 1  |     | AFH  | Turn on the LCD display                                                                   |
| Set Page Address = 0                                                                                       | 0             | 1            | 0  | 1  | 1  | 0  | 0  | 0  | 0  |     | B0H  | Specify the display data RAM page address to 00H                                          |
| Set Column Address (Upper -4bit = 0)<br>Set Column Address (Lower-4bit =4)                                 | 0             | 0            | 0  | 0  | 1  | 0  | 0  | 0  | 0  |     | 10H  | Specify the display data RAM column address to 00H                                        |
|                                                                                                            | 0             | 0            | 0  | 0  | 0  | 0  | 1  | 0  | 0  |     | 01H  |                                                                                           |
| Write Display Data                                                                                         | 1             | Display Data |    |    |    |    |    |    |    |     | -    |                                                                                           |
| Write Other Display Data                                                                                   |               |              |    |    |    |    |    |    |    |     |      |                                                                                           |

## 5. Inspection Standards

| Item                                                     | Criterion for defects                                                                                                                                                                                                                                                                                                                                                                           | Defect type |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 1) Display on inspection                                 | (1) Non display<br>(2) Vertical line is deficient<br>(3) Horizontal line is deficient<br>(4) Cross line is deficient                                                                                                                                                                                                                                                                            | Major       |
| 2) Black / White spot                                    | Size $\Phi$ (mm)<br>$\Phi \leq 0.3$ Acceptable number<br>$0.3 < \Phi \leq 0.45$ Ignore (note)<br>$0.45 < \Phi \leq 0.6$ 3<br>$0.6 < \Phi$ 1<br>0                                                                                                                                                                                                                                                | Minor       |
| 3) Black / White line                                    | Length (mm) Width (mm) Acceptable number<br>$L \leq 10$ $W \leq 0.03$ Ignore<br>$5.0 \leq L \leq 10$ $0.03 < W \leq 0.04$ 3<br>$5.0 \leq L \leq 10$ $0.04 < W \leq 0.05$ 2<br>$1.0 \leq L \leq 10$ $0.05 < W \leq 0.06$ 2<br>$1.0 \leq L \leq 10$ $0.06 < W \leq 0.08$ 1<br>$L \leq 10$ $0.08 < W$ follows 2) point defect<br>Defects separate with each other at an interval of more than 20mm | Minor       |
| 4) Display pattern                                       |  <p>Note: 1) Up to 3 damages acceptable<br/>2) Not allowed if there are two or more pinholes every three-fourth inch.</p>                                                                                                                                                                                     | Minor       |
| 5) Spot-like contrast irregularity                       | Size $\Phi$ (mm) Acceptable Number<br>$\Phi \leq 0.7$ Ignore (note)<br>$0.7 < \Phi \leq 1.0$ 3<br>$1.0 < \Phi \leq 1.5$ 1<br>$1.5 < \Phi$ 0<br>Note: 1) Conformed to limit samples.<br>2) Intervals of defects are more than 30mm.                                                                                                                                                              | Minor       |
| 6) Bubbles in polarizer                                  | Size $\Phi$ (mm) Acceptable Number<br>$\Phi \leq 0.4$ Ignore (note)<br>$0.4 < \Phi \leq 0.65$ 2<br>$0.65 < \Phi \leq 1.2$ 1<br>$1.2 < \Phi$ 0                                                                                                                                                                                                                                                   | Minor       |
| 7) Scratches and dent on the polarizer                   | Scratches and dent on the polarizer shall be in the accordance with “2) Black/white spot”, and “3) Black/White line”.                                                                                                                                                                                                                                                                           | Minor       |
| 8) Stains on the surface of LCD panel                    | Stains which cannot be removed even when wiped lightly with a soft cloth or similar cleaning.                                                                                                                                                                                                                                                                                                   | Minor       |
| 9) Rainbow color                                         | No rainbow color is allowed in the optimum contrast on state within the active area.                                                                                                                                                                                                                                                                                                            | Minor       |
| 10) Viewing area encroachment                            | Polarizer edge or line is visible in the opening viewing area due to polarizer shortness or sealing line.                                                                                                                                                                                                                                                                                       | Minor       |
| 11) Bezel appearance                                     | Rust and deep damages that are visible in the bezel are rejected.                                                                                                                                                                                                                                                                                                                               | Minor       |
| 12) Defect of land surface contact                       | Evident crevices that are visible are rejected.                                                                                                                                                                                                                                                                                                                                                 | Minor       |
| 13) Parts mounting                                       | (1) Failure to mount parts<br>(2) Parts not in the specifications are mounted<br>(3) For example: Polarity is reversed, HSC or TCP falls off.                                                                                                                                                                                                                                                   | Minor       |
| 14) Part alignment                                       | (1) LSI, IC lead width is more than 50% beyond pad outline.<br>(2) More than 50% of LSI, IC leads is off the pad outline.                                                                                                                                                                                                                                                                       | Minor       |
| 15) Conductive foreign matter (solder ball, solder hips) | (1) $0.45 < \Phi$ , $N \geq 1$<br>(2) $0.3 < \Phi \leq 0.45$ , $N \geq 1$ , $\Phi$ : Average diameter of solder ball (unit: mm)<br>(3) $0.5 < L$ , $N \geq 1$ , L: Average length of solder chip (unit: mm)                                                                                                                                                                                     | Minor       |
| 16) Bezel flaw                                           | Bezel claw missing or not bent                                                                                                                                                                                                                                                                                                                                                                  | Minor       |
| 17) Indication on name plate (sampling indication label) | (1) Failure to stamp or label error, or not legible.(all acceptable if legible)<br>(2) The separation is more than 1/3 for indication discoloration, in which the characters can be checked.                                                                                                                                                                                                    | Minor       |

## 6. Handling Precautions

### 6.1 Mounting method

A panel of LCD module made by our company consists of two thin glass plates with polarizers that easily get damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board (PCB), extreme care should be used when handling the LCD modules.

### 6.2 Cautions of LCD handling and cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Ketene
- Aromatics

### 6.3 Caution against static charge

The LCD module uses C-MOS LSI drivers. So we recommend you:

Connect any unused input terminal to  $V_{dd}$  or  $V_{ss}$ . Do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

### 6.4 Packaging

- Module employs LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity.

### 6.5 Caution for operation

-It is an indispensable condition to drive LCD module within the limits of the specified voltage since the higher voltage over the limits may cause the shorter life of LCD module.

-An electrochemical reaction due to DC (direct current) causes LCD undesirable deterioration so that the uses of DC (direct current) drive should be avoided.

-Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD module may show dark color in them. However those phenomena do not mean malfunction or out of order of LCD module, which will come back in the specified operating temperature.

### 6.6 Storage

In the case of storing for a long period of time, the following ways are recommended:

- Storage in polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with not desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping the storage temperature range.
- Storing with no touch on polarizer surface by any thing else.

### 6.7 Safety

-It is recommendable to crush damaged or unnecessary LCD into pieces and to wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.

-When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well at once with soap and water.

# 7. Packaging Specifications

|  |                                                 |          |         |          |
|--|-------------------------------------------------|----------|---------|----------|
|  | <b>Packaging Specifications</b><br>HTG12864K1-K | Approved | Checked | Designed |
|  |                                                 |          |         |          |

## 6.1 Packaging Material

| No | Item                 | Dimensions (mm)               | 1PCS Weight (KG) | Quantity | Total Weight |
|----|----------------------|-------------------------------|------------------|----------|--------------|
| 1  | COG                  | 89.8*54.6*7.0                 | 0.041            | 200      | 8.2          |
| 2  | PE Bag               | 120*120                       | 0.001            | 200      | 0.2          |
| 3  | Foam Rubber Cushion  | 310*170                       | 0.0175           | 8        | 0.14         |
| 4  | Partition Al         | 310*170*100                   | 0.30             | 4        | 1.2          |
| 5  | Product Box          | 330*180*120 (neutral packing) | 0.45             | 4        | 1.8          |
| 6  | Carton               | 480*390*330 (neutral packing) | 1.0              | 1        | 1.0          |
| 7  | Tape                 |                               |                  | AR       |              |
| 8  | Label Specifications |                               |                  | 1        |              |
| 9  | Label Rohs           |                               |                  | 1        |              |
| 10 | Label ESD            |                               |                  | 1        |              |

6.2. Total LCD Weight in carton: 12.5 KG±10%

6.3. Packaging Specifications and Quantity:

(1) Quantity Of Spacer: A1\*4

(2) Total LCM quantity in carton: quantity per box 50\* no of boxes 4 = 200

