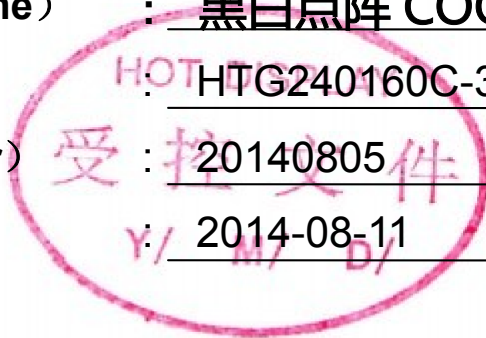




鑫洪泰
HOT DISPLAY

HTG240160C-31W-40C05

产品名称 (Product name) : 黑白点阵 COG
 型号 (Model) : HTG240160C-31W-40C05
 编号 (Part number) : 20140805
 日期 (Date) : 2014-08-11



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

| | | |
|-------------------|------------------|-------------------|
| 编制 Prepared by | 审核 Checked by | 核准 Approved by |
| | | |

编码: QR-R-011 A/0

序号:

| Rev. | Descriptions | Date |
|------|-------------------|------------|
| 01 | Prelimiay Release | 2014-08-11 |
| | | |
| | | |

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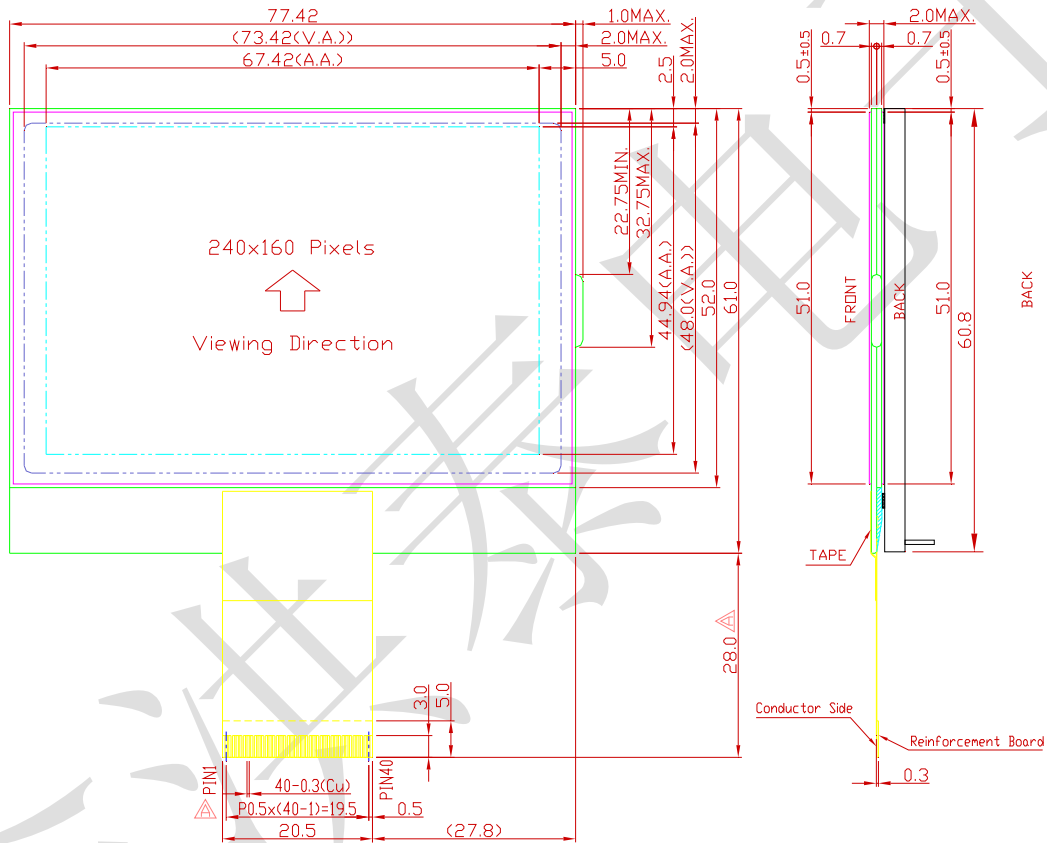
1. Basic Specifications

1.1 Display Specifications

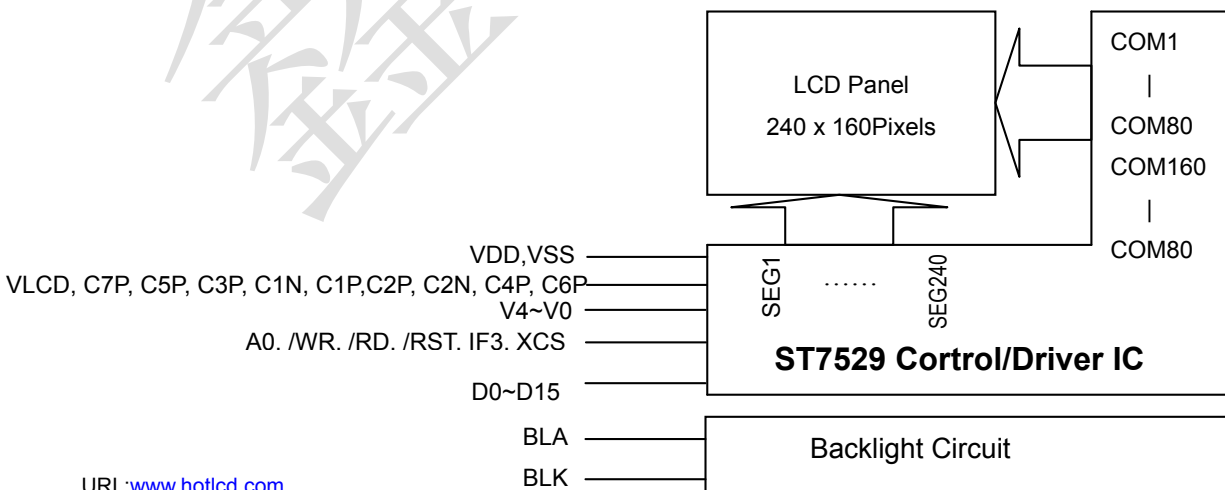
- 1>LCD Display Mode : FSTN, Positive, Transflective
- 2>Viewing Angle : 6H
- 3>Driving Method : 1/160 Duty, 1/12 Bias
- 4>Backlight : White LED

1.2 Mechanical Specifications

- 1>Outline Dimension : 77.42x 61.0 x 4.9mm (See attached Outline Drawing for Details)



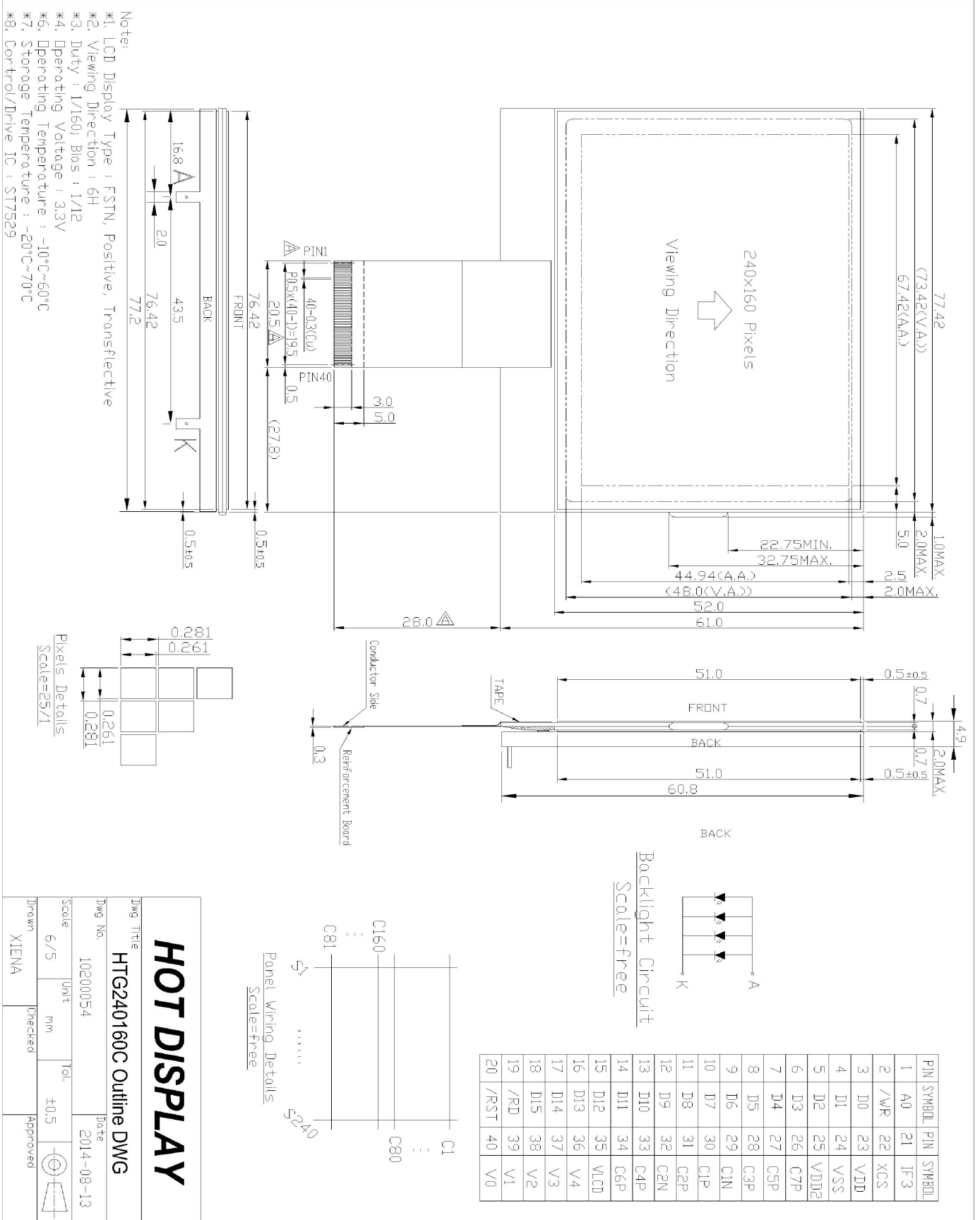
1.3 Circuit Diagram



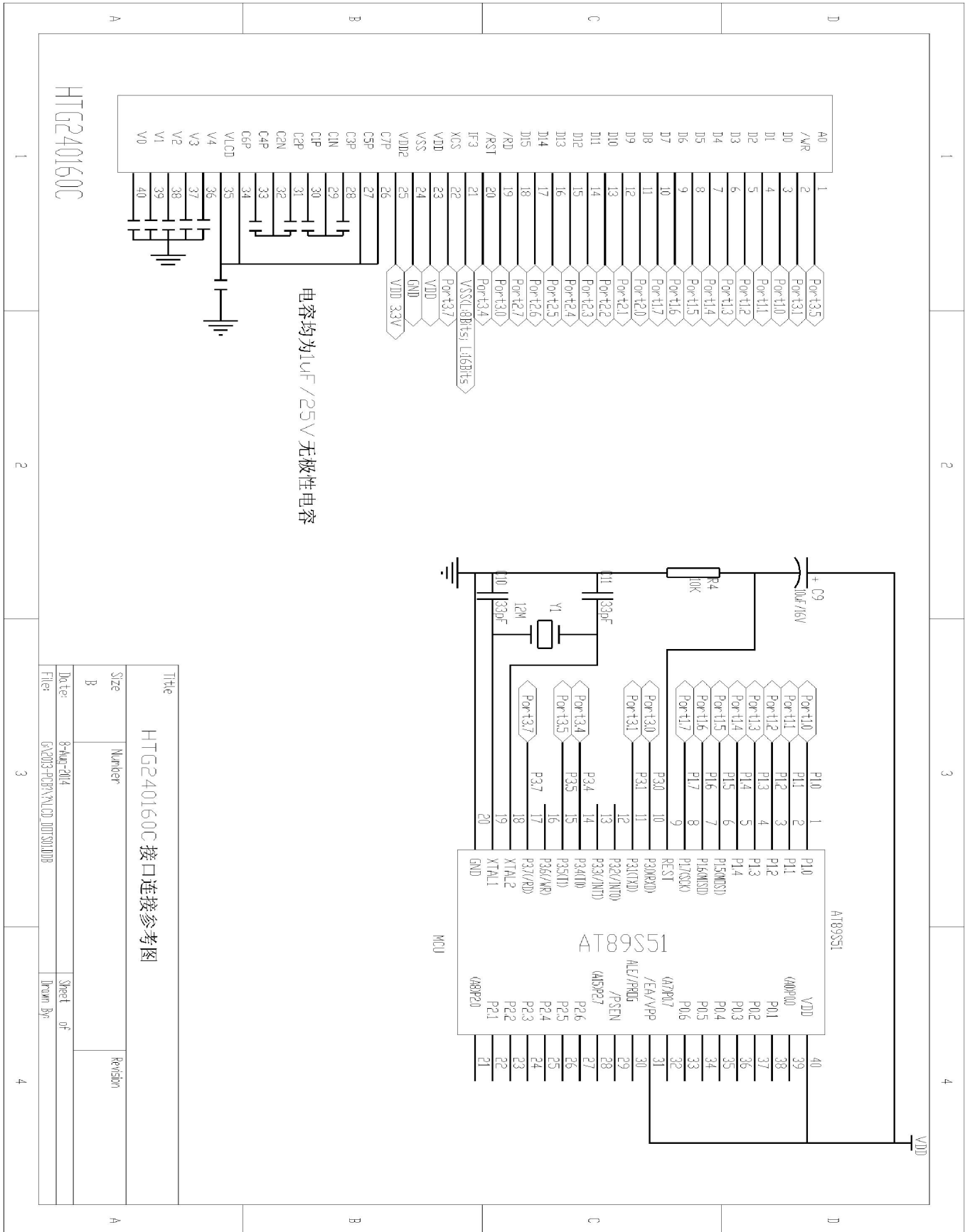
1.4 Terminal Function

| Pin No. | Pin Name | Function | | | | | | |
|---------|--------------------------|--|-----|--------------------|---|--------------------------|---|--------------------------|
| 1 | A0 | Register select input pin | | | | | | |
| 2 | /WR | Write(/WR) Control Signal Input | | | | | | |
| 3~18 | D0~D15 | They connect to the standard 8-bit or 16-bit MPU bus via the 8/16 –bit bi-directional bus. When the following interface is selected and the XCS pin is high, the following pins become high impedance, which should be fixed to VDD or VSS. 1. 8-bit parallel: D15-D8 are in the state of high impedance 2. Serial interface: D15-D0 are in the state of high impedance | | | | | | |
| 19 | /RD | Read (/RD) Control Signal Input. | | | | | | |
| 20 | /RST | Reset input pin | | | | | | |
| 21 | IF3 | Parallel / Serial data input select input <table border="1" style="margin-left: 20px;"> <tr> <td>IF3</td> <td>MPU interface type</td> </tr> <tr> <td>H</td> <td>80series 16-bit parallel</td> </tr> <tr> <td>L</td> <td>80 series 8-bit parallel</td> </tr> </table> | IF3 | MPU interface type | H | 80series 16-bit parallel | L | 80 series 8-bit parallel |
| IF3 | MPU interface type | | | | | | | |
| H | 80series 16-bit parallel | | | | | | | |
| L | 80 series 8-bit parallel | | | | | | | |
| 22 | XCS | Chip select input pins | | | | | | |
| 23 | VDD | Power supply(3.3V) | | | | | | |
| 24 | VSS | Negative Power Supply,0V | | | | | | |
| 25 | VDD2 | Power Supply For Logic Circuit 3.3V | | | | | | |
| 26 | C7P | DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1N terminal. | | | | | | |
| 27 | C5P | | | | | | | |
| 28 | C3P | | | | | | | |
| 29 | C1N | | | | | | | |
| 30 | C1P | | | | | | | |
| 31 | C2P | | | | | | | |
| 32 | C2N | | | | | | | |
| 33 | C4P | | | | | | | |
| 34 | C6P | | | | | | | |
| 35 | VLCD | | | | | | | |
| 36~40 | V4~V0 | LCD driver supply voltages | | | | | | |

1.5 Product Outline



1.6 Schematic Diagram



| | | | |
|-------|-----------------------------|--------------------|----|
| Title | | HTG240160C 接口连接参考图 | |
| Size | Number | Revision | |
| B | | | |
| Date: | 8-Aug-2014 | Sheet | of |
| File: | GA2013-PCB/VLCD_OUT/SH1.DDB | Drawn By: | |

2. Absolute Maximum Ratings

| Items | Symbol | MIN. | MAX. | Unit | Condition |
|-----------------------|-----------------|-----------------|----------------------|------|----------------------|
| Supply Voltage | V _{DD} | V _{SS} | +3.3 | V | V _{SS} = 0V |
| Input Voltage | V _{IN} | V _{SS} | V _{DD} +0.3 | V | V _{SS} = 0V |
| Operating Temperature | T _{OP} | -10 | +60 | °C | No Condensation |
| Storage Temperature | T _{st} | -20 | +70 | °C | No Condensation |

3. Electrical Characteristics

3.1 DC Characteristics

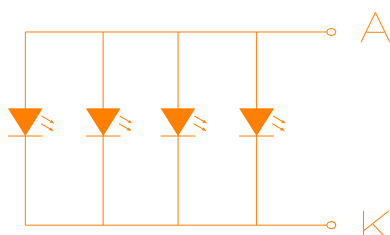
V_{SS} = 0V, Top = 25°C

| Items | Symbol | MIN. | TYP. | MAX. | Unit | Condition |
|---|---------------------|---------------------|------|---------------------|------|--|
| Operating Voltage | V _{DD} | 2.4 | - | 3.3 | V | V _{DD} |
| High-level input voltage | V _{IH} | 0.7 V _{DD} | - | V _{DD} | V | - |
| Low-level input voltage | V _{IL} | V _{SS} | - | 0.3 V _{DD} | V | |
| High level Output Current | I _{OH} | 0.5 | - | - | mA | V _{DD} =2.7V, V _{OH} =2.2V |
| Low level Output Current | I _{OL} | - | - | -0.5 | mA | V _{DD} =2.7V, V _{OL} =0.5V |
| Operation Current | I _{op} | 100 | - | 220 | μA | V _{DD} =3.0V |
| Supply step-up output Voltage circuit | V _{LCDOUT} | - | - | 18 | V | Relative to V _{SS} |
| Voltage regulator circuit Operating voltage | V _{LCDIN} | - | - | 18 | V | Relative to V _{SS} |

3.2 LED Backlight Circuit

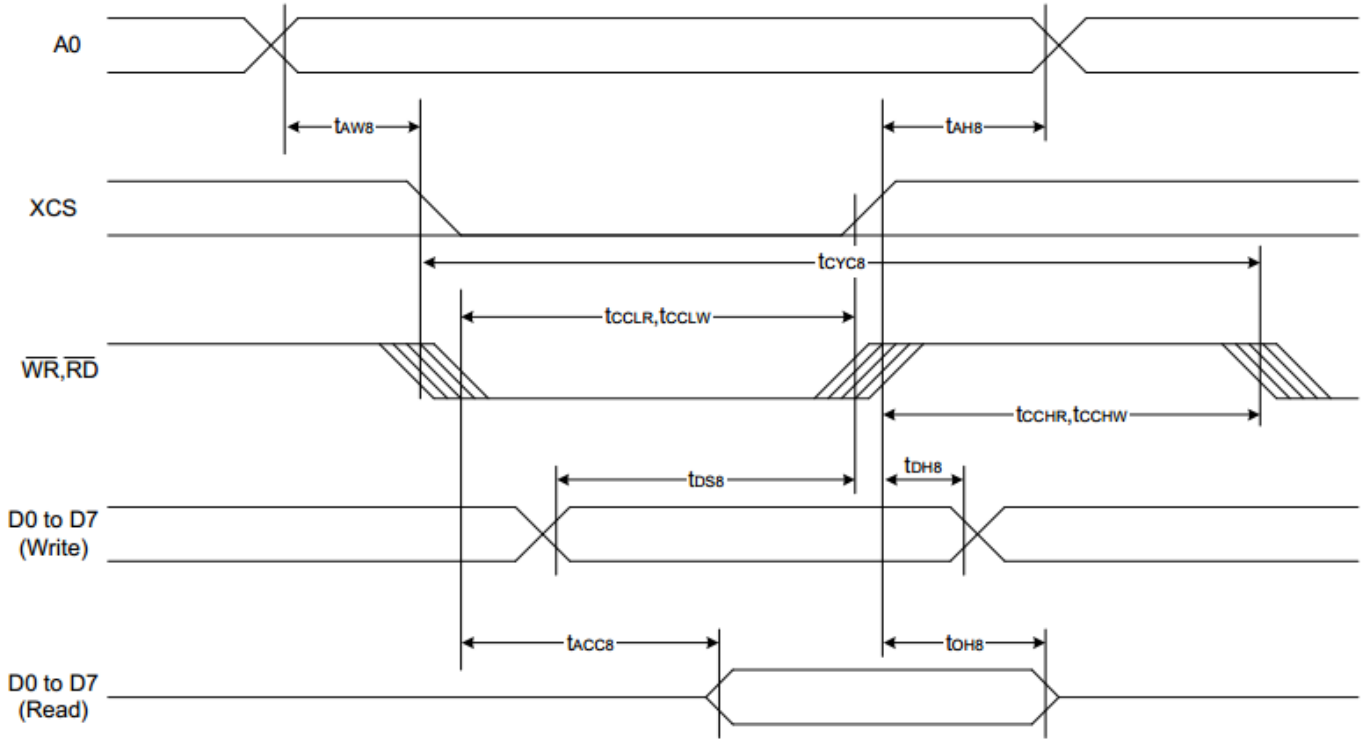
V_{SS} = 0V, Top = 25°C

| Items | Symbol | MIN. | TYP. | MAX. | Unit | Condition |
|-----------------|--------------------|------|------|------|------|-----------------|
| Forward Voltage | V _f BLA | - | 3.1 | - | V | V _{DD} |
| Forward Current | I _f BLA | - | 60 | 65 | mA | V _{DD} |



3.3 AC Characteristics

3.3.1 8080 Mode System Bus Timing



(VDD = 3.3V , Ta = -30 to 85°C, Die)

| Item | Signal | Symbol | Condition | Rating | | Units |
|------------------------------|----------|--------|-------------|--------|------|-------|
| | | | | Min. | Max. | |
| Address hold time | A0 | tAH8 | - | 20 | - | ns |
| Address setup time | | tAW8 | - | 20 | - | |
| System cycle time | | tCYC8 | - | 200 | - | |
| Enable L pulse width (WRITE) | WR | tCCLW | - | 100 | - | |
| Enable H pulse width (WRITE) | | tCCHW | - | 100 | - | |
| Enable L pulse width (READ) | RD | tCCLR | - | 100 | - | |
| Enable H pulse width (READ) | | tCCHR | - | 100 | - | |
| WRITE Data setup time | D0 to D7 | tDS8 | - | 150 | - | |
| WRITE Address hold time | | tDH8 | - | 20 | - | |
| READ access time | | tACC8 | CL = 100 pF | - | 40 | |
| READ Output disable time | | tOH8 | CL = 100 pF | - | 30 | |

Vss = 0V, Top = 25°C

(VDD = 2.7 V , Ta = -30 to 85°C,Die)

| Item | Signal | Symbol | Condition | Rating | | Units |
|------------------------------|----------|--------|-------------|--------|------|-------|
| | | | | Min. | Max. | |
| Address hold time | A0 | tAH8 | - | 20 | - | ns |
| Address setup time | | tAW8 | - | 30 | - | |
| System cycle time | | tCYC8 | - | 250 | - | |
| Enable L pulse width (WRITE) | WR | tCCLW | - | 150 | - | |
| Enable H pulse width (WRITE) | | tCCHW | - | 100 | - | |
| Enable L pulse width (READ) | RD | tCCLR | - | 150 | - | |
| Enable H pulse width (READ) | | tCCHR | - | 100 | - | |
| WRITE Data setup time | D0 to D7 | tDS8 | - | 200 | - | |
| WRITE Address hold time | | tDH8 | - | 20 | - | |
| READ access time | | tACC8 | CL = 100 pF | - | 40 | |
| READ Output disable time | | tOH8 | CL = 100 pF | - | 30 | |

*1 The input signal rise time and fall time (t_r , t_f) is specified at 15 ns or less. When the system cycle time is extremely fast, $(t_r + t_f) \leq (t_{CYC8} - t_{CCLW} - t_{CCHW})$ for $(t_r + t_f) \leq (t_{CYC8} - t_{CCLR} - t_{CCHR})$ are specified.

*2 All timing is specified using 20% and 80% of VDD as the reference.

*3 tCCLW and tCCLR are specified as the overlap between XCS being "L" and WR and RD being at the "L" level.

3.4 Reset Timing

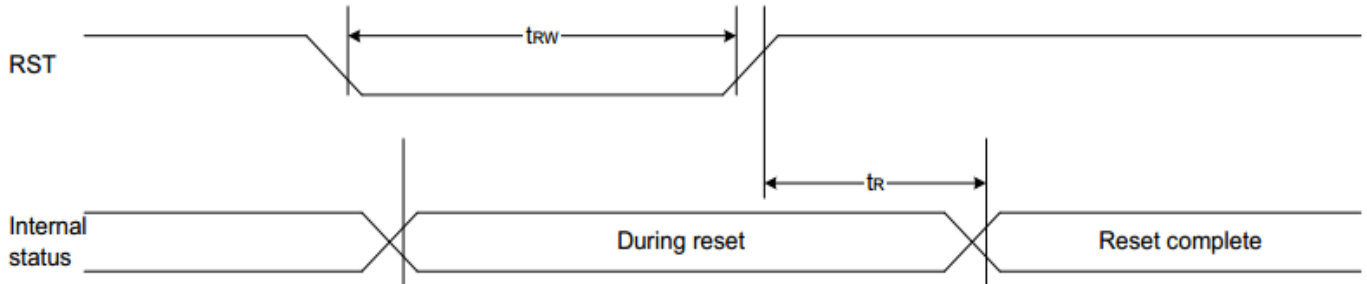


Fig 43.

(VDD = 3.3V , Ta = -30 to 85°C, Die)

| Item | Signal | Symbol | Condition | Rating | | | Units |
|-----------------------|--------|--------|-----------|--------|------|------|-------|
| | | | | Min. | Typ. | Max. | |
| Reset time | | tR | - | - | - | 1 | us |
| Reset "L" pulse width | RST | tRW | - | 1 | - | - | us |

(VDD = 2.7V , Ta = -30 to 85°C, Die)

| Item | Signal | Symbol | Condition | Rating | | | Units |
|-----------------------|--------|--------|-----------|--------|------|------|-------|
| | | | | Min. | Typ. | Max. | |
| Reset time | | tR | - | - | - | 1.5 | us |
| Reset "L" pulse width | RST | tRW | - | 1.5 | - | - | us |

4. Function specifications

4.1 The Parallel Interface

| Shared | 8080 Mode | | Function |
|--------|-----------|-----|-------------------------|
| A0 | /RD | /WR | |
| H | L | H | Reads the display data |
| H | H | L | Writes the display data |
| L | L | H | Status read |
| L | H | L | 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

4.4.1 Memory Map (3B3P, 8-bit mode)

| | | | Column | | | | | | | | |
|-------------------------|-----------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|---------------------|---------------------|---------------------|---------------------|
| LCD read direction ↓ | CI = 0 | | 0 | | | 1 | | | 84 | | |
| | CI = 1 | | 84 | | | 83 | | | 0 | | |
| | Pixel | | P0 | P1 | P2 | P3 | P4 | P5 | P252 | P253 | P254 |
| | Data Line | | D7' _{1,0} | D7' _{2,0} | D7' _{3,0} | D7' _{1,1} | D7' _{2,1} | D7' _{3,1} | D7' _{1,84} | D7' _{2,84} | D7' _{3,84} |
| | | D6' _{1,0} | D6' _{2,0} | D6' _{3,0} | D6' _{1,1} | D6' _{2,1} | D6' _{3,1} | D6' _{1,84} | D6' _{2,84} | D6' _{3,84} | |
| | | D5' _{1,0} | D5' _{2,0} | D5' _{3,0} | D5' _{1,1} | D5' _{2,1} | D5' _{3,1} | D5' _{1,84} | D5' _{2,84} | D5' _{3,84} | |
| | | D4' _{1,0} | D4' _{2,0} | D4' _{3,0} | D4' _{1,1} | D4' _{2,1} | D4' _{3,1} | D4' _{1,84} | D4' _{2,84} | D4' _{3,84} | |
| | | D3' _{1,0} | D3' _{2,0} | D3' _{3,0} | D3' _{1,1} | D3' _{2,1} | D3' _{3,1} | D3' _{1,84} | D3' _{2,84} | D3' _{3,84} | |
| Block | LI = 0 | LI = 1 | | | | | | | | | |
| 0 | 0 | 159 | | | | | | | | | |
| | 1 | 158 | | | | | | | | | |
| | 2 | 157 | | | | | | | | | |
| | 3 | 156 | | | | | | | | | |
| 1 | 4 | 155 | | | | | | | | | |
| | 5 | 154 | | | | | | | | | |
| | 6 | 153 | | | | | | | | | |
| | 7 | 152 | | | | | | | | | |
| 2 | 8 | 151 | | | | | | | | | |
| | 9 | 150 | | | | | | | | | |
| 38 | 152 | 7 | | | | | | | | | |
| | 153 | 6 | | | | | | | | | |
| | 154 | 5 | | | | | | | | | |
| | 155 | 4 | | | | | | | | | |
| 39 | 156 | 3 | | | | | | | | | |
| | 157 | 2 | | | | | | | | | |
| | 158 | 1 | | | | | | | | | |
| | 159 | 0 | | | | | | | | | |
| SEGout | | | 0 | 1 | 2 | 3 | 4 | 5 | 252 | 253 | 254 |

4.4.2 Memory Map (3B3P, 16-bit mode)

| | | | Column | | | | | | | | | |
|--------------------|-----------|--------|---------------------|--------------------|---------------------|---------------------|--------------------|---------------------|----------------------|---------------------|----------------------|-----|
| LCD read direction | CI = 0 | | 0 | | | 1 | | | 84 | | | |
| | CI = 1 | | 84 | | | 83 | | | 0 | | | |
| | Pixel | | P0 | P1 | P2 | P3 | P4 | P5 | P252 | P253 | P254 | |
| | Data Line | | D15' _{1,0} | D7' _{1,0} | D15' _{2,0} | D15' _{1,1} | D7' _{1,1} | D15' _{2,1} | D15' _{1,84} | D7' _{1,84} | D15' _{2,84} | |
| | | | D14' _{1,0} | D6' _{1,0} | D14' _{2,0} | D14' _{1,1} | D6' _{1,1} | D14' _{2,1} | D14' _{1,84} | D6' _{1,84} | D14' _{2,84} | |
| | | | D13' _{1,0} | D5' _{1,0} | D13' _{2,0} | D13' _{1,1} | D5' _{1,1} | D13' _{2,1} | D13' _{1,84} | D5' _{1,84} | D13' _{2,84} | |
| | | | D12' _{1,0} | D4' _{1,0} | D12' _{2,0} | D12' _{1,1} | D4' _{1,1} | D12' _{2,1} | D12' _{1,84} | D4' _{1,84} | D12' _{2,84} | |
| | | | D11' _{1,0} | D3' _{1,0} | D11' _{2,0} | D11' _{1,1} | D3' _{1,1} | D11' _{2,1} | D11' _{1,84} | D3' _{1,84} | D11' _{2,84} | |
| Block | LI = 0 | LI = 1 | | | | | | | | | | |
| 0 | 0 | 159 | | | | | | | | | | |
| | 1 | 158 | | | | | | | | | | |
| | 2 | 157 | | | | | | | | | | |
| | 3 | 156 | | | | | | | | | | |
| 1 | 4 | 155 | | | | | | | | | | |
| | 5 | 154 | | | | | | | | | | |
| | 6 | 153 | | | | | | | | | | |
| | 7 | 152 | | | | | | | | | | |
| 2 | 8 | 151 | | | | | | | | | | |
| | 9 | 150 | | | | | | | | | | |
| 38 | 152 | 7 | | | | | | | | | | |
| | 153 | 6 | | | | | | | | | | |
| | 154 | 5 | | | | | | | | | | |
| | 155 | 4 | | | | | | | | | | |
| 39 | 156 | 3 | | | | | | | | | | |
| | 157 | 2 | | | | | | | | | | |
| | 158 | 1 | | | | | | | | | | |
| | 159 | 0 | | | | | | | | | | |
| SEGout | | | 0 | 1 | 2 | 3 | 4 | 5 | | 252 | 253 | 254 |

4.5 Display Commands

Ext=0 or Ext=1

| Index | Command | A0 | RD | WR | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Function | Hex | Parameter |
|-------|---------|----|----|----|----|----|----|----|----|----|----|----|-----------|-----|-----------|
| 1 | Ext In | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | Ext=0 Set | 30 | None |
| 2 | Ext Out | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | Ext=1 Set | 31 | None |

Ext=0

| Index | Command | A0 | RD | WR | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Function | Hex | Parameter |
|-------|----------|----|----|----|----|----|----|----|----|----|----|----|-----------------------|-----|-----------|
| 1 | DISON | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | Display On | AF | None |
| 2 | DISOFF | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | Display Off | AE | None |
| 3 | DISNOR | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | Normal Display | A6 | None |
| 4 | DISINV | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | Inverse Display | A7 | None |
| 5 | COMSCN | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | COM Scan Direction | BB | 1 byte |
| 6 | DISCTRL | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | Display Control | CA | 3 bytes |
| 7 | SLPIN | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | Sleep In | 95 | None |
| 8 | SLPOUT | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | Sleep Out | 94 | None |
| 9 | LASET | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | Line Address Set | 75 | 2 bytes |
| 10 | CASET | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | Column Address Set | 15 | 2 bytes |
| 11 | DATSDR | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | Data Scan Direction | BC | 3 bytes |
| 12 | RAMWR | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | Writing to Memory | 5C | Data |
| 13 | RAMRD | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | Reading from Memory | 5D | Data |
| 14 | PTLIN | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | Partial display in | A8 | 2 bytes |
| 15 | PTLOUT | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | Partial display out | A9 | None |
| 16 | RMWIN | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Read and Modify Write | E0 | None |
| 17 | RMWOUT | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | RMW end | EE | None |
| 18 | ASCSET | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | Area Scroll Set | AA | 4 bytes |
| 19 | SCSTART | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | Scroll Start Set | AB | 1 byte |
| 20 | OSCON | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | Internal OSC on | D1 | None |
| 21 | OSCOFF | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | Internal OSC off | D2 | None |
| 22 | PWRCTRL | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | Power Control | 20 | 1 byte |
| 23 | VOLCTRL | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | EC control | 81 | 2 bytes |
| 24 | VOLUP | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | EC increase 1 | D6 | None |
| 25 | VOLDOWN | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | EC decrease 1 | D7 | None |
| 26 | RESERVED | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | Not Use | 82 | 0 |

| | | | | | | | | | | | | | | | |
|----|---------|---|---|---|-----------|---|---|---|---|---|---|-------------|-----------------|----|--------|
| 27 | EPSRRD1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | READ Register1 | 7C | None |
| 28 | EPSRRD2 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | READ Register2 | 7D | None |
| 29 | NOP | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | NOP Instruction | 25 | None |
| 30 | STREAD | 0 | 0 | 1 | Read Data | | | | | | | Status Read | | | |
| 31 | EPINT | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | Initial code(1) | 07 | 1 byte |

Ext=1

| Index | Command | A0 | RD | WR | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Function | Hex | Parameter |
|-------|------------|----|----|----|----|----|----|----|----|----|----|----|----------------------|-----|-----------|
| 1 | Gray 1 Set | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | FRAME 1 Gray PWM Set | 20 | 16 bytes |
| 2 | Gray 2 Set | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | FRAME 2 Gray PWM Set | 21 | 16 bytes |
| 3 | ANASET | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | Analog Circuit Set | 32 | 3 bytes |
| 4 | SWINT | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | Software Initial | 34 | None |
| 5 | EPCTIN | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | Control EEPROM | CD | 1 byte |
| 6 | EPCOUT | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | Cancel EEPROM | CC | None |
| 7 | EPMWR | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | Write to EEPROM | FC | None |
| 8 | EPMRD | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | Read from EEPROM | FD | None |

Note: The table above is for 8-bit interface. For the application of 16-bit interface, fill D15~8 with 0, and other bits are just the same with the table above.

4.6 Basic Operating Sequence

```

void intial(void)
{
    delay(50);
    write_inst(0x30);           //EXT = 0
    write_inst(0x94);         //sleep out
    write_inst(0xD1);        //OSC on

    write_inst(0xBB);        //com scan
    direc. = 0~65 / 160~66
    write_data(0x01);        //

    write_inst(0xCA);        //display control
    write_data(0x04);        //CL dividing
    ratio = 0
    write_data(0x27);        //duty
    write_data(0x00);        //N-Line Low
    Byte

    write_inst(0x31);        //EXT = 1
    write_inst(0x32);        //analog
    write_data(0x07);        //OSC freq
    write_data(0x00);        //booster effic.
    write_data(0x02);        //bias

    write_inst(0x30);        //EXT = 0

}

    write_inst(0x81);        //EC control
    write_data(0x0E);        //vop[5:0]
    write_data(0x04);        //vop[8:6]

    write_inst(0x20);        //power control
    write_data(0x03);        //D0 = regulator
    / D1 = follwer / D3 = booster
    //VB - VF VR : VB=OFF, VF=1, VR=1, 0x03
    外部电压电路

    write_inst(0x60);        //Close Auto
    sampling

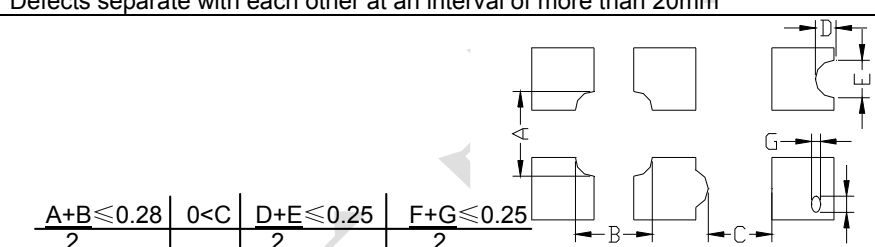
    write_inst(0xA7);        //inverse
    display

    write_inst(0xBC);        //data scan
    direc.
    write_data(0x00);        //c/l
    com/line,ci,li:address scan direc.
    write_data(0x00);        //BGR
    write_data(0x02);        //gray scale
    3b3pd1 方式 1//

    write_inst(0xa9);
    write_inst(0xAF);        //display on

    write_inst(0x30);
    delay(50);
    
```


5. Inspection Standards

| Item | Criterion for defects | Defect type |
|--|---|-------------|
| 1) Display on inspection | (1) Non display (2) Vertical line is deficient (3) Horizontal line is deficient (4) Cross line is deficient | Major |
| 2) Black / White spot | Size Φ (mm) Acceptable number $\Phi \leq 0.3$ Ignore (note) $0.3 < \Phi \leq 0.45$ 3 $0.45 < \Phi \leq 0.6$ 1 $0.6 < \Phi$ 0 | Minor |
| 3) Black / White line | Length (mm) Width (mm) Acceptable number $L \leq 10$ $W \leq 0.03$ Ignore $5.0 \leq L \leq 10$ $0.03 < W \leq 0.04$ 3 $5.0 \leq L \leq 10$ $0.04 < W \leq 0.05$ 2 $1.0 \leq L \leq 10$ $0.05 < W \leq 0.06$ 2 $1.0 \leq L \leq 10$ $0.06 < W \leq 0.08$ 1 $L \leq 10$ $0.08 < W$ follows 2) point defect Defects separate with each other at an interval of more than 20mm | Minor |
| 4) Display pattern |  <p>Note: 1) Up to 3 damages acceptable 2) Not allowed if there are two or more pinholes every three-fourth inch.</p> | Minor |
| 5) Spot-like contrast irregularity | Size Φ (mm) Acceptable Number $\Phi \leq 0.7$ Ignore (note) $0.7 < \Phi \leq 1.0$ 3 $1.0 < \Phi \leq 1.5$ 1 $1.5 < \Phi$ 0 Note: 1) Conformed to limit samples. 2) Intervals of defects are more than 30mm. | Minor |
| 6) Bubbles in polarizer | Size Φ (mm) Acceptable Number $\Phi \leq 0.4$ Ignore (note) $0.4 < \Phi \leq 0.65$ 2 $0.65 < \Phi \leq 1.2$ 1 $1.2 < \Phi$ 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 (2) Parts not in the specifications are mounted (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. (2) More than 50% of LSI, IC leads is off the pad outline. | Minor |
| 15) Conductive foreign matter (solder ball, solder hips) | (1) $0.45 < \Phi$, $N \geq 1$ (2) $0.3 < \Phi \leq 0.45$, $N \geq 1$, Φ : Average diameter of solder ball (unit: mm) (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) (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 directly 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

| | | Packaging Specifications | | | <table border="1"> <tr> <td>Approved</td> <td>Checked</td> <td>Designed</td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </table> | | Approved | Checked | Designed | | | |
|------------------------|----------------------|-------------------------------|------------------|----------|---|--|----------|---------|----------|--|--|--|
| Approved | Checked | Designed | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | HTG240160C | | | | | | | | | | |
| 6.1 Packaging Material | | | | | | | | | | | | |
| No | Item | Dimensions (mm) | 1PCS Weight (KG) | Quantity | Total Weight | | | | | | | |
| 1 | COG | 77.42*61.0*4.0 | 0.035 | 200 | 7.0 | | | | | | | |
| 2 | PE Bag | 100*100 | 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 | 0.9 | | | | | | | |
| 7 | Tape | | | AR | | | | | | | | |
| 8 | Label Specifications | | | 1 | | | | | | | | |
| 9 | Label Rohs | | | 1 | | | | | | | | |
| 10 | Label ESD | | | 1 | | | | | | | | |

6.2. Total LCD Weight in carton: 11.2 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

