# Specification for HINK 2.9''EPD

# Model NO.:HINK-E029A01

## Customer approval

| | |
|---|---|
| **Customer** | |
| **Approval by** | |
| **Date of approval** | |

| Prepared by | Checked by | Approval by |
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| Version | Content | Date | Producer |
|---|---|---|---|
| A/0 | New release | 2015/01/10 | |
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# 1 General Description

HINK-E029A01 is an Active Matrix Electrophoretic Display(AMEPD) , with interface and a reference system design. The 2.9' active area contains 296×128 pixels, and has 1-bit full display capabilities. An integrated circuit contains gate buffer, source buffer, interface, timing control logic, oscillator, DC-DC. SRAM. LUT ,VCOM,and border are supplied with each panel.

# 2 Features

296×128 pixels display

White reflectance above 43%

Contrast ratio above 10：1

Ultra wide viewing angle

Ultra low power consumption

Pure reflective mode

Bi-stable display Commercial temperature range

Landscape, portrait modes

Hard-coat antiglare display surface

Ultra Low current deep sleep mode

On chip display RAM

Waveform stored in On-chip OTP

Serial peripheral interface available

On-chip oscillator

On-chip booster and regulator control for generating VCOM, Gate and Source driving voltage

I2C signal master interface to read external temperature sensor

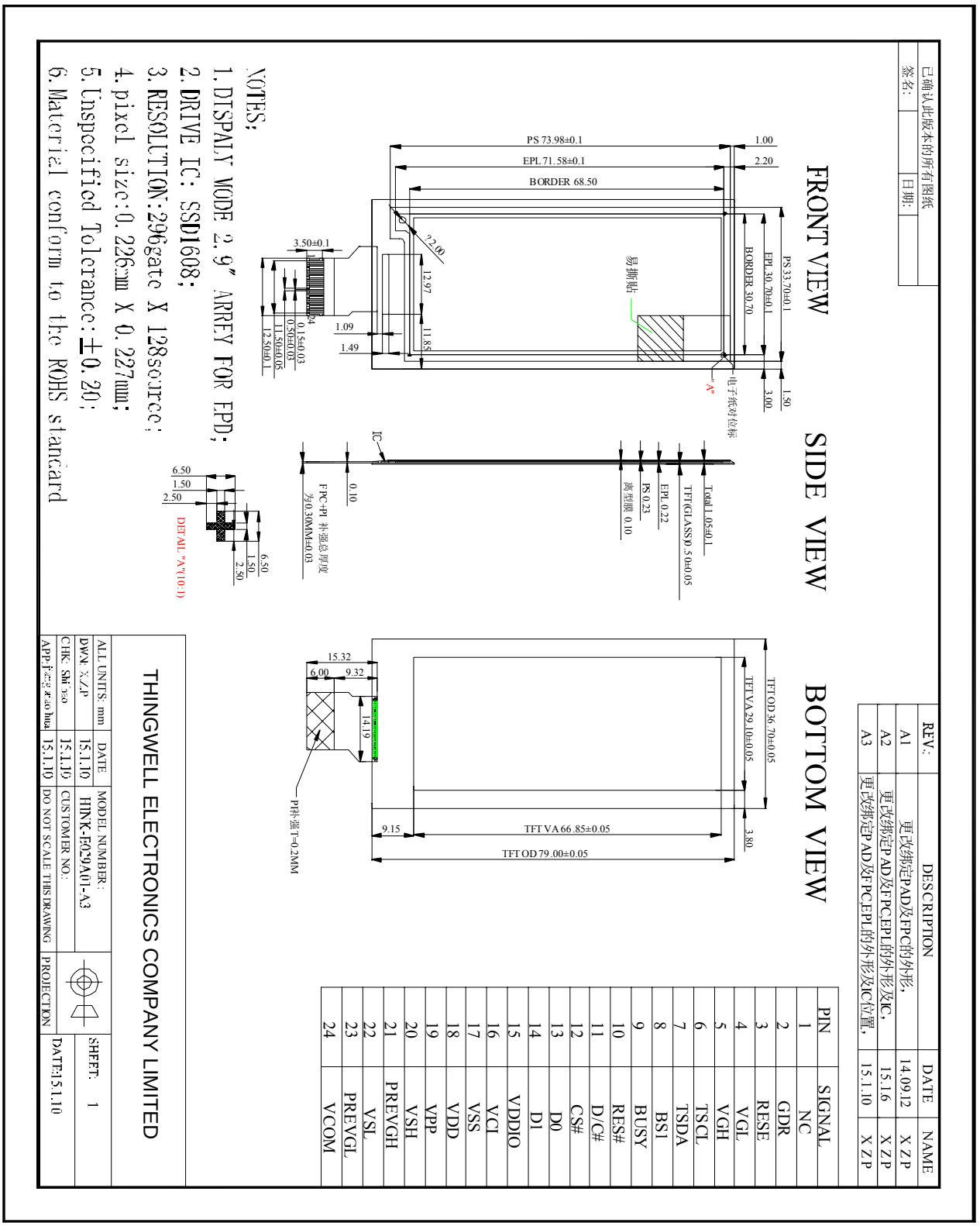
# 3 Application

Electronic Shelf Label System

# 4 Mechanical Specifications

| Parameter | Specifications | Unit | Remark |
|---|---|---|---|
| Screen Size | 2.9 | Inch | |
| Display Resolution | 128(H)×296(V) | Pixel | dpi:112 |
| Active Area | 29.05×66.89 | mm | |
| Pixel Pitch | 0.226×0.227 | mm | |
| Pixel Configuration | Rectangle | | |
| Outline Dimension | 36.7(H)×79.0 (V) ×1.05(D) | mm | |
| Weight | 4±0.5 | g | |

# 5 Mechanical Drawing of EPD module




| PIN | SIGNAL |
|---|---|
| 1 | NC |
| 2 | GDR |
| 3 | RESE |
| 4 | VGL |
| 5 | VGH |
| 6 | TSCL |
| 7 | TSDA |
| 8 | BS1 |
| 9 | BUSY |
| 10 | RES# |
| 11 | D/C# |
| 12 | CS# |
| 13 | D0 |
| 14 | D1 |
| 15 | VDDIO |
| 16 | VCI |
| 17 | VSS |
| 18 | VDD |
| 19 | VPP |
| 20 | VSH |
| 21 | PREVGH |
| 22 | VSL |
| 23 | PREVGL |
| 24 | VCOM |

# 6 Input/Output Terminals

## 6.1 Pin out List

| Pin # | Type | Single | Description | Remark |
|---|---|---|---|---|
| **1** | | NC | No connection and do not connect with other NC pins | Keep Open |
| **2** | O | GDR | N-Channel MOSFET Gate Drive Control | |
| **3** | O | RESE | Current Sense Input for the Control Loop | |
| **4** | C | VGL | Negative Gate driving voltage | |
| **5** | C | VGH | Positive Gate driving voltage | |
| **6** | O | TSCL | I2C Interface to digital temperature sensor Clock pin | |
| **7** | I/O | TSDA | I2C Interface to digital temperature sensor Date pin | |
| **8** | I | BS1 | Bus selection pin | Note 6-5 |
| **9** | O | BUSY | Busy state output pin | Note 6-4 |
| **10** | I | RES # | Reset | Note 6-3 |
| **11** | I | D/C # | Data /Command control pin | Note 6-2 |
| **12** | I | CS # | Chip Select input pin | Note 6-1 |
| **13** | I/O | D0 | serial clock pin (SPI) | |
| **14** | I/O | D1 | serial data pin (SPI) | |
| **15** | I | VDDIO | Power for interface logic pins | |
| **16** | I | VCI | Power Supply pin for the chip | |
| **17** | | VSS | Ground | |
| **18** | C | VDD | Core logic power pin | |
| **19** | C | VPP | Power Supply for OTP Programming | |
| **20** | C | VSH | Positive Source driving voltage | |
| **21** | C | PREVGH | Power Supply pin for VGH and VSH | |
| **22** | C | VSL | Negative Source driving voltage | |
| **23** | C | PREVGL | Power Supply pin for VCOM, VGL and VSL | |
| **24** | C | VCOM | VCOM driving voltage | |

Note 6-1: This pin (CS#) is the chip select input connecting to the MCU. The chip is enabled for MCU communication:only when CS# is pulled LOW.

Note 6-2: This pin (D/C#) is Data/Command control pin connecting to the MCU. When the pin is pulled HIGH,the data will be interpreted as data. When the pin is pulled LOW, the data will be interpreted as command.

Note 6-3: This pin (RES#) is reset signal input. The Reset is active low.

Note 6-4: This pin (BUSY) is Busy state output pin. When Busy is Low the operation of chip should not be interrupted and any commands should not be issued to the module. The driver IC will put Busy pin Low when the driver IC is working such as:

- Outputting display waveform; or
- Communicating with digital temperature sensor

Note 6-5: This pin (BS1) is for 3-line SPI or 4-line SPI selection. When it is “Low”, 4-line SPI is selected. When it is “High”, 3-line SPI (9 bits SPI) is selected. Please refer to below Table.

**Table: Bus interface selection**

| BS1 | MPU Interface |
|---|---|
| L | 4-lines serial peripheral interface (SPI) |
| H | 3-lines serial peripheral interface (SPI) - 9 bits SPI |

## 6.2 MCU Interface

### 6.2.1 MCU Serial Peripheral Interface (4-wire SPI)

The 4-wire SPI consists of SCLK (serial clock), SDIN (serial data), D/C# and CS#. D0 acts as SCLK and D1 acts as SDIN.

**Table -1 : Control pins of 4-wire Serial Peripheral interface**

| Function | CS# pin | D/C# pin | SCLK pin |
|---|---|---|---|
| Write command | L | L | ↑ |
| Write data | L | H | ↑ |

**Note:** ↑ stands for rising edge of signal

SDIN is shifted into an 8-bit shift register in the order of D7, D6, ... D0. The data byte in the shift register is written to the Graphic Display Data RAM (RAM) or command register in the same clock. Under serial mode, only write operations are allowed.

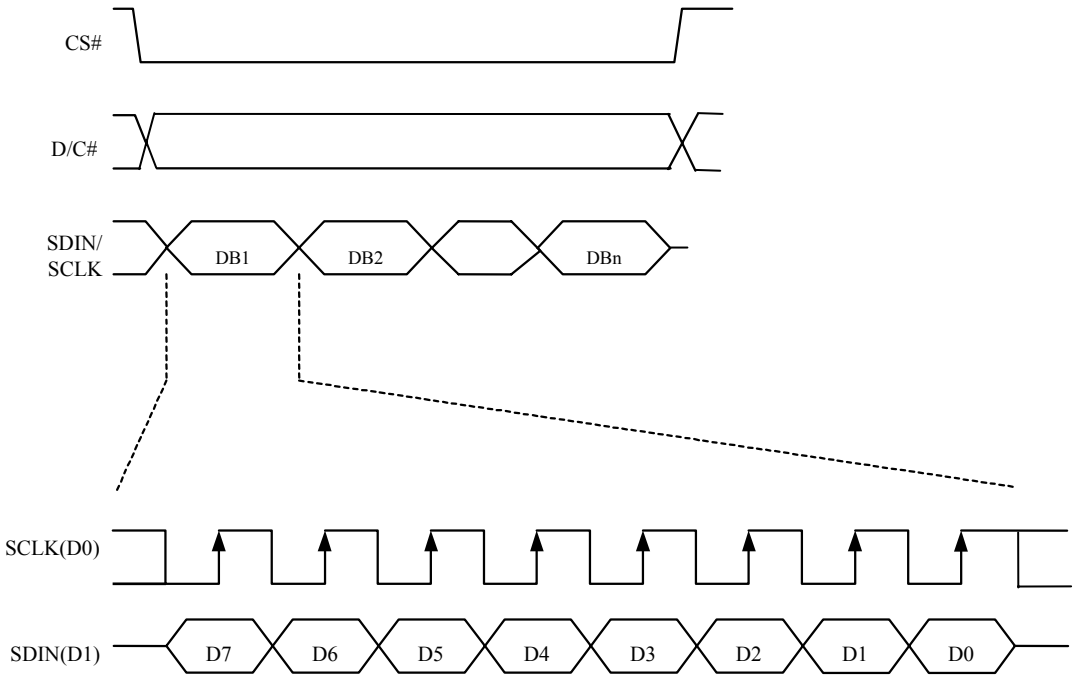



**Figure 6-1 : Write procedure in 4-wire Serial Peripheral Interface mode**

### 6.2.2 MCU Serial Peripheral Interface (3-wire SPI)

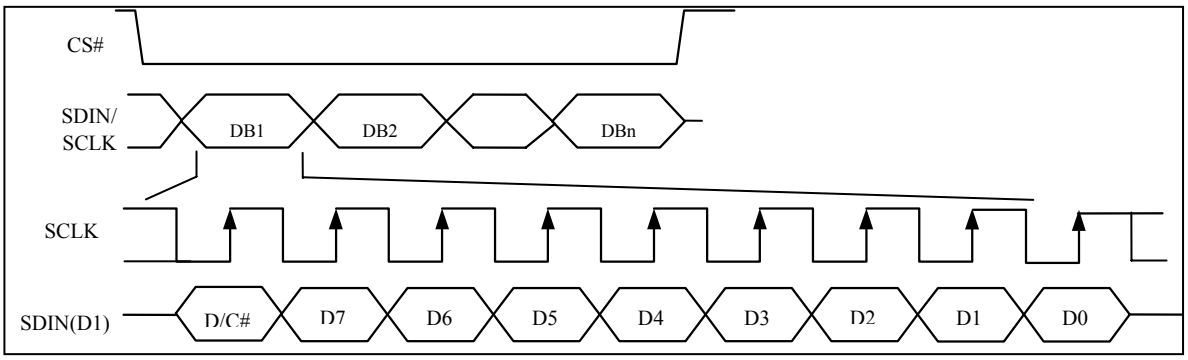
The 3-wire serial interface consists of SCLK (serial clock), SDIN (serial data) and CS#. In SPI mode, D0 acts as SCLK and D1 acts as SDIN. The operation is similar to 4-wire serial interface while D/C# pin is not used. There are altogether 9-bits will be shifted into the shift register in sequence: D/C# bit, D7 to D0 bit. The D/C# bit (first bit of the sequential data) will determine the following data byte in the shift register is written to the Display Data RAM (D/C# bit = 1) or the command register (D/C# bit = 0). Under serial mode, only write operations are allowed.

**Table -2 : Control pins of 3-wire Serial Peripheral interface**

| Function | CS# pin | D/C# pin | SCLK pin |
|---|---|---|---|
| Write command | L | Tie LOW | ↑ |
| Write data | L | Tie LOW | ↑ |

**Note:** ↑ stands for rising edge of signal

**Figure 6-1 : Write procedure in 3-wire Serial Peripheral Interface mode**



## 6.3 External Temperature Sensor Interface

The module provides two I/O lines [TSDA and TSCL] for connecting digital temperature sensor for temperature reading sensing. TSDA will treat as SDA line and TSCL will treat as SCL line. They are required connecting with external pull-up resistor when they are used to connect to the temperature sensor.

The following shows how to convert into temperature value:

1) When the Temperature value MSByte bit D11 = 0, the temperature is positive and value (DegC) = + (Temperature value)/16

2) When the Temperature value MSByte bit D11 = 1, the temperature is negative and value (DegC) = ~ (2's complement of Temperature value)/16

| 12-bit binary (2's complement) | Hexadecimal Value | Decimal Value | Value [DegC] |
|---|---|---|---|
| 0111 1111 0000 | 7F0 | 2032 | 127 |
| 0111 1110 1110 | 7EE | 2030 | 126.875 |
| 0111 1110 0010 | 7E2 | 2018 | 126.125 |
| 0111 1101 0000 | 7D0 | 2000 | 125 |
| 0001 1001 0000 | 190 | 400 | 25 |
| 0000 0000 0010 | 002 | 2 | 0.125 |
| 0000 0000 0000 | 000 | 0 | 0 |
| 1111 1111 1110 | FFE | -2 | -0.125 |
| 1110 0111 0000 | E70 | -400 | -25 |
| 1100 1001 0010 | C92 | -878 | -54.875 |
| 1100 1001 0000 | C90 | -880 | -55 |

## 7 Command Table

| R/W# | D/C# | Hex | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Command | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Driver Output control | Gate setting<br>Set A[8:0] = 127h<br>Set B[2:0] = 0h |
| 0 | 1 | | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | | |
| 0 | 1 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | A8 | | |
| 0 | 1 | | 0 | 0 | 0 | 0 | 0 | B2 | B1 | B0 | | |
| 0 | 0 | 0C | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | Booster Soft start Control | Set A[7:0] = CFh<br>Set B[7:0] = CEh<br>Set C[7:0] = 8Dh |
| 0 | 1 | | 1 | $A_6$ | $A_5$ | $A_4$ | $A_3$ | $A_2$ | $A_1$ | $A_0$ | | |
| 0 | 1 | | 1 | $B_6$ | $B_5$ | $B_4$ | $B_3$ | $B_2$ | $B_1$ | $B_0$ | | |
| 0 | 1 | | 1 | $C_6$ | $C_5$ | $C_4$ | $C_3$ | $C_2$ | $C_1$ | $C_0$ | | |
| 0 | 0 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | Deep Sleep mode | Deep Sleep mode Control<br>A[0] : Description<br>0 Normal Mode [POR]<br>1 Enter Deep Sleep Mode |
| 0 | 1 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $A_0$ | | |
| 0 | 0 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | Data Entry mode setting | Define data entry sequence<br>A [1:0] = ID[1:0]<br>Address automatic increment / decrement setting<br>The setting of incrementing or decrementing of the address counter can be made independently in each upper and lower bit of the address.<br><br>00 –Y decrement, X decrement,<br>01 –Y decrement, X increment,<br>10 –Y increment, X decrement,<br>11 –Y increment, X increment [POR]<br><br>A[2] = AM<br>Set the direction in which the address counter is updated automatically after data are written to the RAM.<br><br>AM= 0, the address counter is updated in the X direction. [POR]<br>AM = 1, the address counter is updated in the Y direction. |
| 0 | 1 | | 0 | 0 | 0 | 0 | 0 | $A_2$ | $A_1$ | $A_0$ | | |
| 0 | 0 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | SWRESET | It resets the commands and parameters to their S/W Reset default values except R10h-Deep Sleep Mode<br>Note: RAM are unaffected by this command. |

| R/W# | D/C# | Hex | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Command | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 1A | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | Temperature Sensor Control (Write to temperature register) | Write to temperature register.<br><br>A[7:0] – MSByte 01111111[POR]<br>B[7:0] – LSByte 11110000[POR] |
| 0 | 1 | | $A_7$ | $A_6$ | $A_5$ | $A_4$ | $A_3$ | $A_2$ | $A_1$ | $A_0$ | | |
| 0 | 1 | | $B_7$ | $B_6$ | $B_5$ | $B_4$ | 0 | 0 | 0 | 0 | | |
| 0 | 0 | 20 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | Master Activation | Activate Display Update Sequence<br><br>The Display Update Sequence Option is located at R22h<br><br>User should not interrupt this operation to avoid corruption of panel images. |
| 0 | 0 | 21 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Display Update Control 1 | Option for Display Update<br>Bypass Option used for Pattern Display, which is used for display the RAM content into the Display<br><br>OLD RAM Bypass option<br>A [7]<br>A[7] = 1: Enable bypass<br>A[7] = 0: Disable bypass [POR]<br><br>A[4] value will be used as for bypass.<br>A[4] = 0 [POR]<br><br>A[1:0] Initial Update Option - Source Control<br><br>A[1:0] GSC GSD<br>01 [POR] GS0 GS1 |
| 0 | 1 | | $A_7$ | 0 | 0 | $A_4$ | $A_3$ | $A_2$ | $A_1$ | $A_0$ | | |

<table>
<tr><th>R/W#</th><th>D/C#</th><th>Hex</th><th>D7</th><th>D6</th><th>D5</th><th>D4</th><th>D3</th><th>D2</th><th>D1</th><th>D0</th><th>Command</th><th>Description</th></tr>
<tr><td>0</td><td>0</td><td>22</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td rowspan="2">Display Update Control 2</td><td rowspan="2">Display Update Sequence Option:<br>Enable the stage for Master Activation<br><table><tr><td></td><td>Paramete (in Hex)</td></tr><tr><td>Enable Clock Signal,<br>Then Enable CP<br>Then Load Temperature value<br>Then Load LUT<br>Then INIITIAL DISPLAY<br>Then PATTERN DISPLAY<br>Then Disable CP<br>Then Disable OSC</td><td>FF<br>[POR]</td></tr><tr><td>To Enable Clock Signal (CLKEN=1)</td><td>80</td></tr><tr><td>To Enable Clock Signal,<br>then Enable CP<br>(CLKEN=1, CPEN=1)</td><td>C0</td></tr><tr><td>To INITIAL DISPLAY + PATTEN DISPLAY</td><td>0C</td></tr><tr><td>To INITIAL DISPLAY</td><td>08</td></tr><tr><td>To DISPLAY PATTEN</td><td>04</td></tr><tr><td>To Disable CP,<br>then Disable Clock Signal<br>(CLKEN=1, CPEN=1)</td><td>03</td></tr><tr><td>To Disable Clock Signal (CLKEN=1)</td><td>01</td></tr></table>Remark:<br>CLKEN=1:<br>If CLS=VDDIO then Enable OSC<br>If CLS=VSS then Enable External Clock<br>CLKEN=0:<br>If CLS=VDDIO then Disable OSC<br>AND<br>INTERNAL CLOCK Signal = VSS,</td></tr>
<tr><td>0</td><td>1</td><td></td><td>$A_7$</td><td>$A_6$</td><td>$A_5$</td><td>$A_4$</td><td>$A_3$</td><td>$A_2$</td><td>$A_1$</td><td>$A_0$</td></tr>
<tr><td>0</td><td>0</td><td>24</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>Write RAM</td><td>After this command, data entries will be written into the RAM until another command is written. Address pointers will advance accordingly.</td></tr>
<tr><td>0</td><td>0</td><td>2C</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td rowspan="2">Write VCOM register</td><td rowspan="2">Write VCOM register from MCU interface</td></tr>
<tr><td>0</td><td>1</td><td></td><td>$A_7$</td><td>$A_6$</td><td>$A_5$</td><td>$A_4$</td><td>$A_3$</td><td>$A_2$</td><td>$A_1$</td><td>$A_0$</td></tr>
</table>

| R/W# | D/C# | Hex | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Command | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 32 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | Write LUT register | Write LUT register from MCU [240 bits],<br>(excluding the VSH/VSL and Dummy bit) |
| 0<br>0<br>0<br>…<br>0<br>0 | 1<br>1<br>1<br>…<br>1<br>1 | | LUT<br>[30 bytes] | | | | | | | | | |
| 0 | 0 | 3A | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | Set dummy line period | Set A[7:0] = 1Ah |
| 0 | 1 | | 0 | $A_6$ | $A_5$ | $A_4$ | $A_3$ | $A_2$ | $A_1$ | $A_0$ | | |
| 0 | 0 | 3B | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | Set Gate line width | Set B[3:0] = 8h |
| 0 | 1 | | 0 | 0 | 0 | 0 | $A_3$ | $A_2$ | $A_1$ | $A_0$ | | |
| 0 | 0 | 3C | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | Border Waveform Control | Select border waveform for VBD<br>A [7] Follow Source at Initial Update Display<br>A [7]=0: [POR]<br>A [7]=1: Follow Source at Initial Update Display for VBD, A [6:0] setting are being overridden at Initial Display STAGE.<br><br>A [6] Select GS Transition/ Fix Level for VBD<br>A [6]=0: Select GS Transition A[3:0] for VBD<br>A [6]=1: Select FIX level Setting A[5:4] for VBD [POR]<br>A [5:4] Fix Level Setting for VBD |
| 0 | 1 | | $A_7$ | $A_6$ | $A_5$ | $A_4$ | 0 | 0 | $A_1$ | $A_0$ | | |

| A[5:4] | VBD level |
|---|---|
| 00 | VSS |
| 01 | VSH |
| 10 | VSL |
| 11[POR] | HiZ |

A [1:0] GS transition setting for VBD (Select waveform like data A[3:2] to data A[1:0])

| A[1:0] | GSA | GSB |
|---|---|---|
| 01 [POR] | GS0 | GS1 |

| R/W# | D/C# | Hex | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Command | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 44 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | Set RAM X - address Start / End position | Specify the start/end positions of the window address in the X direction by an address unit<br><br>A[4:0]: XSA[4:0], XStart, POR = 00h<br>B[4:0]: XEA[4:0], XEnd, POR = 1Dh |
| 0 | 1 | | 0 | 0 | 0 | $A_4$ | $A_3$ | $A_2$ | $A_1$ | $A_0$ | | |
| 0 | 1 | | 0 | 0 | 0 | $B_4$ | $B_3$ | $B_2$ | $B_1$ | $B_0$ | | |
| 0 | 0 | 45 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | Set Ram Y- address Start / End position | Specify the start/end positions of the window address in the Y direction by an address unit<br>A[8:0]: YSA[8:0], YStart, POR = 000h<br>B[8:0]: YEA[8:0], YEnd, POR = 13Fh |
| 0 | 1 | | $A_7$ | $A_6$ | $A_5$ | $A_4$ | $A_3$ | $A_2$ | $A_1$ | $A_0$ | | |
| 0 | 1 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $A_8$ | | |
| 0 | 1 | | $B_7$ | $B_6$ | $B_5$ | $B_4$ | $B_3$ | $B_2$ | $B_1$ | $B_0$ | | |
| 0 | 1 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $B_8$ | | |
| 0 | 0 | 4E | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | Set RAM X address counter | Make initial settings for the RAM X address in the address counter (AC)<br>A[4:0]: XAD[4:0], POR is 00h |
| 0 | 1 | | 0 | 0 | 0 | $A_4$ | $A_3$ | $A_2$ | $A_1$ | $A_0$ | | |
| 0 | 0 | 4F | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | Set RAM Y address counter | Make initial settings for the RAM Y address in the address counter (AC)<br>A[8:0]: YAD8:0], POR is 000h |
| 0 | 1 | | $A_7$ | $A_6$ | $A_5$ | $A_4$ | $A_3$ | $A_2$ | $A_1$ | $A_0$ | | |
| 0 | 1 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $A_8$ | | |
| 0 | 1 | FF | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | NOP | This command is an empty command; it does not have any effect on the display module.<br>However it can be used to terminate Frame Memory Write or Read Commands. |

# 8 Maximum Ratings

**Table 8-1: Maximum Ratings**

| Symbol | Parameter | Rating | Unit |
|---|---|---|---|
| $V_{CI}$ | Logic supply voltage | -0.5 to +4.0 | V |
| $V_{IN}$ | Logic Input voltage | -0.5 to $V_{DDIO}$+0.5 | V |
| $V_{OUT}$ | Logic Output voltage | -0.5 to $V_{DDIO}$+0.5 | V |
| $T_{OPR}$ | Operation temperature range | 0 to 60 | °C |
| $T_{STG}$ | Storage temperature range | -25 to 85 | °C |

Maximum ratings are those values beyond which damages to the device may occur. Functional operation should be restricted to the limits in the Electrical Characteristics tables or Pin Description section

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. This device may be light sensitive. Caution should be taken to avoid exposure of this device to any light source during normal operation. This device is not radiation protected.

# 9 Electrical Characteristics

The following specifications apply for: VSS=0V, VCI=3.0V, $T_{OPR}$=25℃.

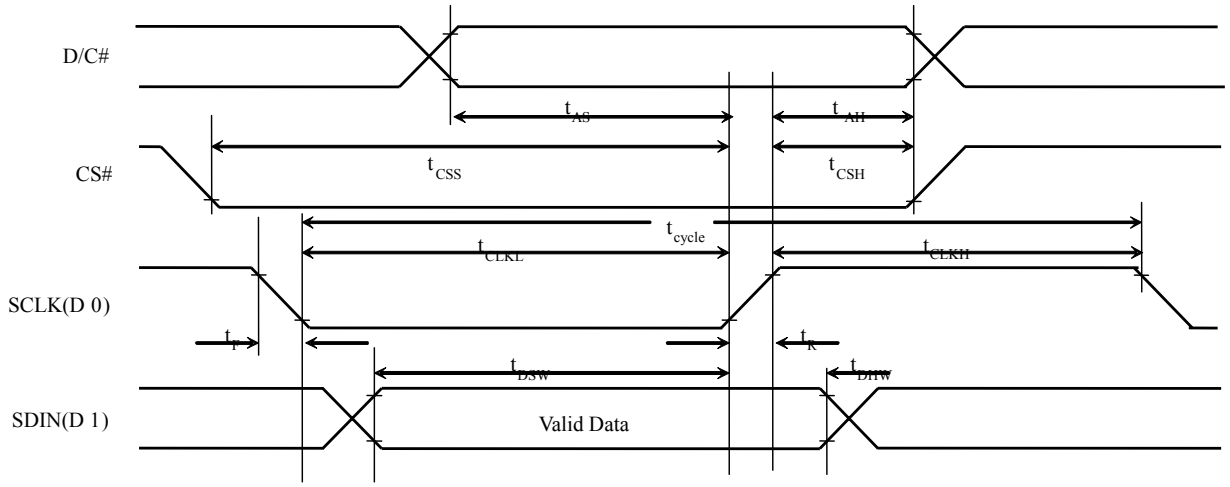
**Table 9-1: DC Characteristics**

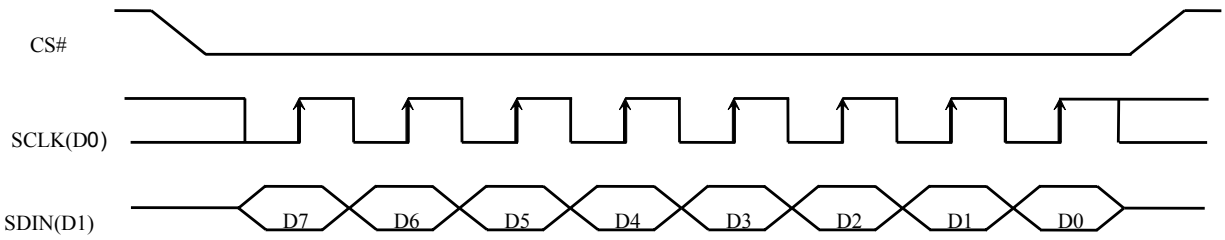
| Symbol | Parameter | Test Condition | Applicable pin | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{CI}$ | VCI operation voltage | | VCI | 2.4 | 3.0 | 3.7 | V |
| $V_{IH}$ | High level input voltage | | D1 (SDIN), D0 (SCLK), CS#, D/C#, RES#, BS1, TSDA, TSCL | $0.8V_{DDIO}$ | | | V |
| $V_{IL}$ | Low level input voltage | | | | | $0.2V_{DDIO}$ | V |
| $V_{OH}$ | High level output voltage | IOH = -100uA | BUSY, TSDA, TSCL | $0.9V_{DDIO}$ | | | V |
| $V_{OL}$ | Low level output voltage | IOL = 100uA | | | | $0.1V_{DDIO}$ | V |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

# 10 Serial Peripheral Interface Timing

The following specifications apply for: VSS=0V, VCI=2.4V to 3.7V, $T_{OPR}$=25℃

| Symbol | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $t_{cycle}$ | Clock Cycle Time | 250 | - | - | ns |
| $t_{AS}$ | Address Setup Time | 150 | - | - | ns |
| $t_{AH}$ | Address Hold Time | 150 | - | - | ns |
| $t_{CSS}$ | Chip Select Setup Time | 120 | - | - | ns |
| $t_{CSH}$ | Chip Select Hold Time | 60 | - | - | ns |
| $t_{DSW}$ | Write Data Setup Time | 50 | - | - | ns |
| $t_{DHW}$ | Write Data Hold Time | 15 | - | - | ns |
| $t_{CLKL}$ | Clock Low Time | 100 | - | - | ns |
| $t_{CLKH}$ | Clock High Time | 100 | - | - | ns |
| $t_R$ | Rise Time [20% ~ 80%] | - | - | 15 | ns |
| $t_F$ | Fall Time [20% ~ 80%] | - | - | 15 | ns |



## 11 Power Consumption

| Parameter | Symbol | Conditions | TYP | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| Panel power consumption during update | - | - | 26.4 | 40 | mW | - |
| Power consumption in standby mode | - | - | - | 0.017 | mW | - |

## 12 Reference Circuit

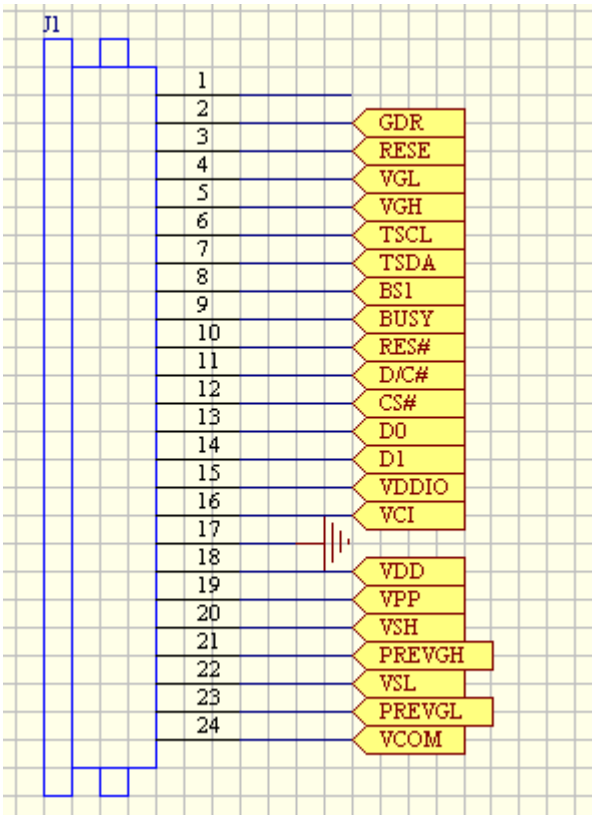



**Figure . 12-1**

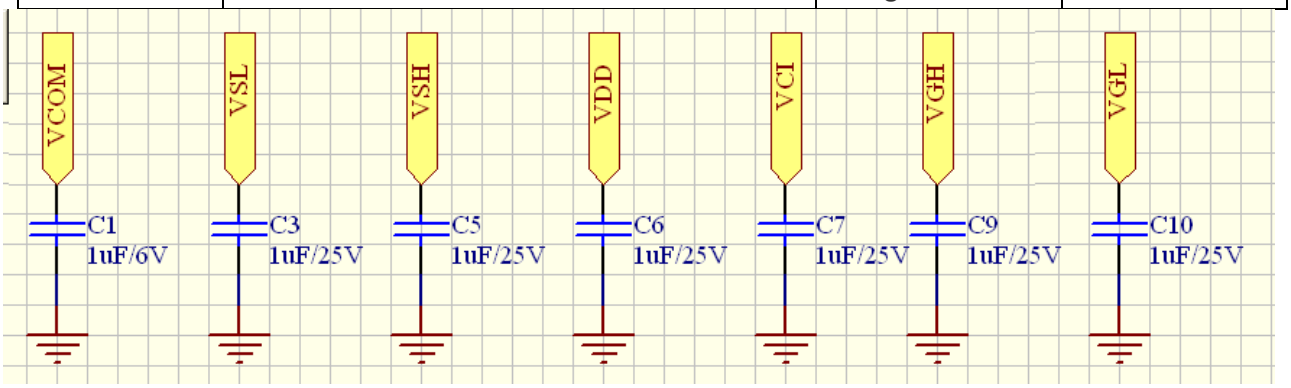



**Figure . 12-2**

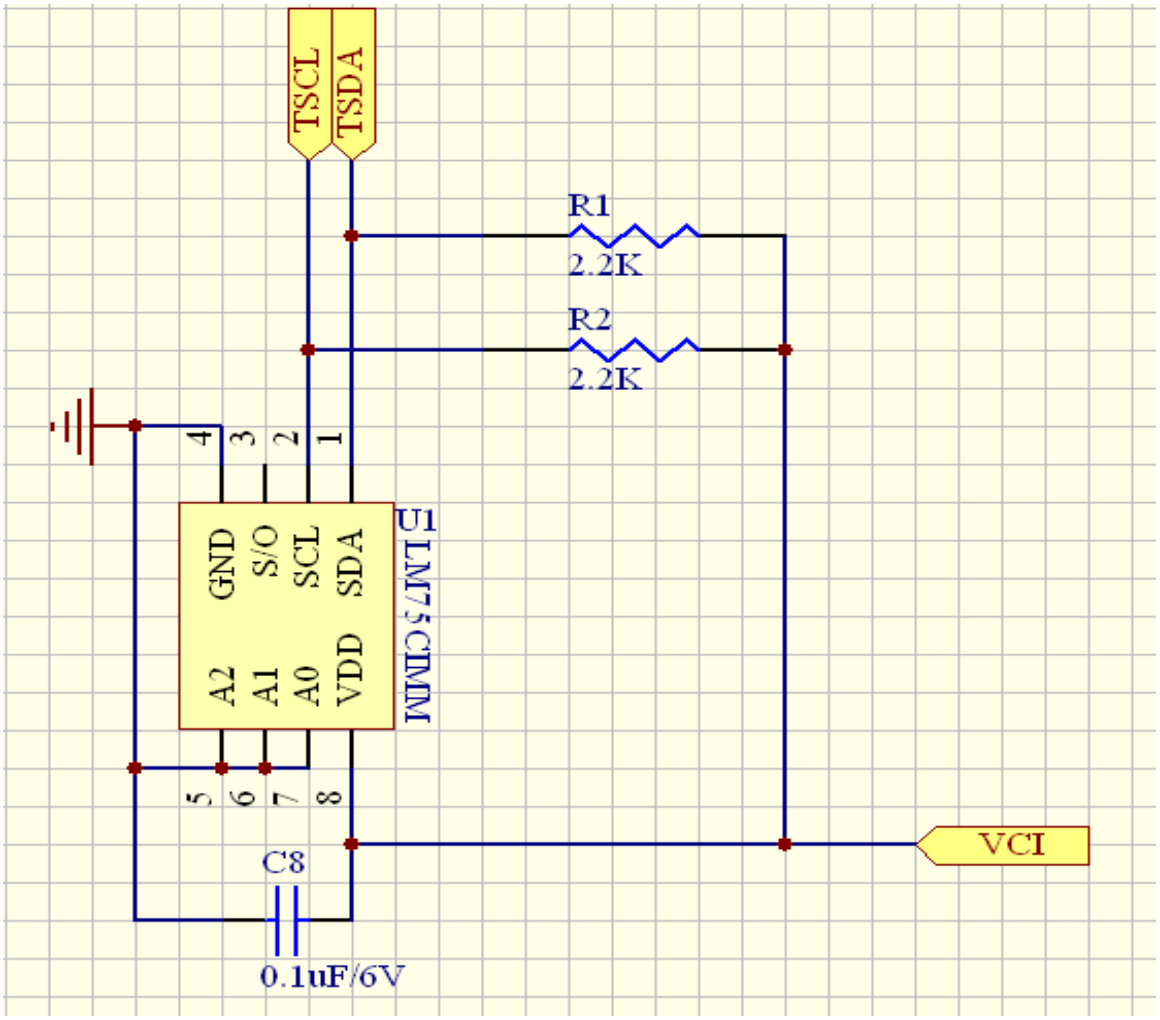



**Figure . 12-3**

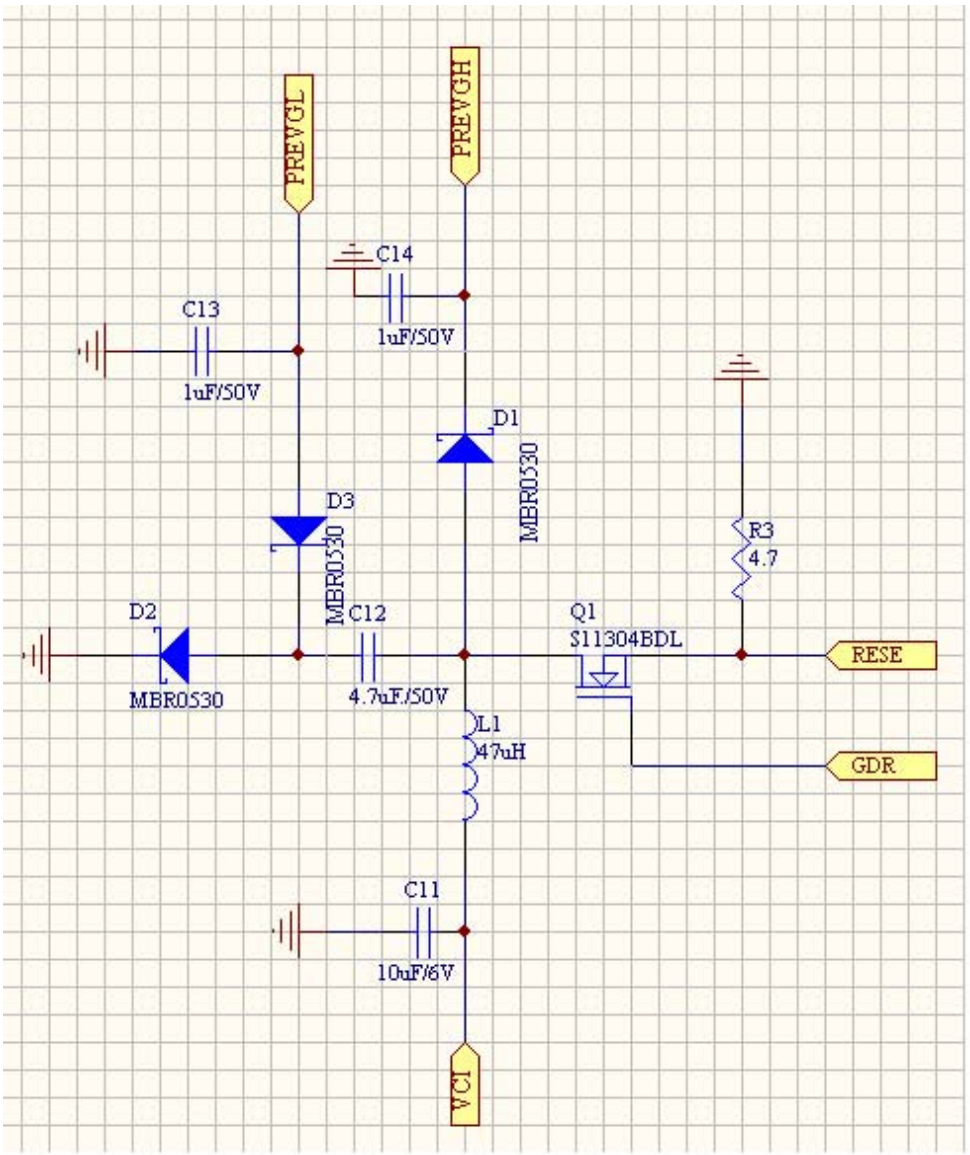
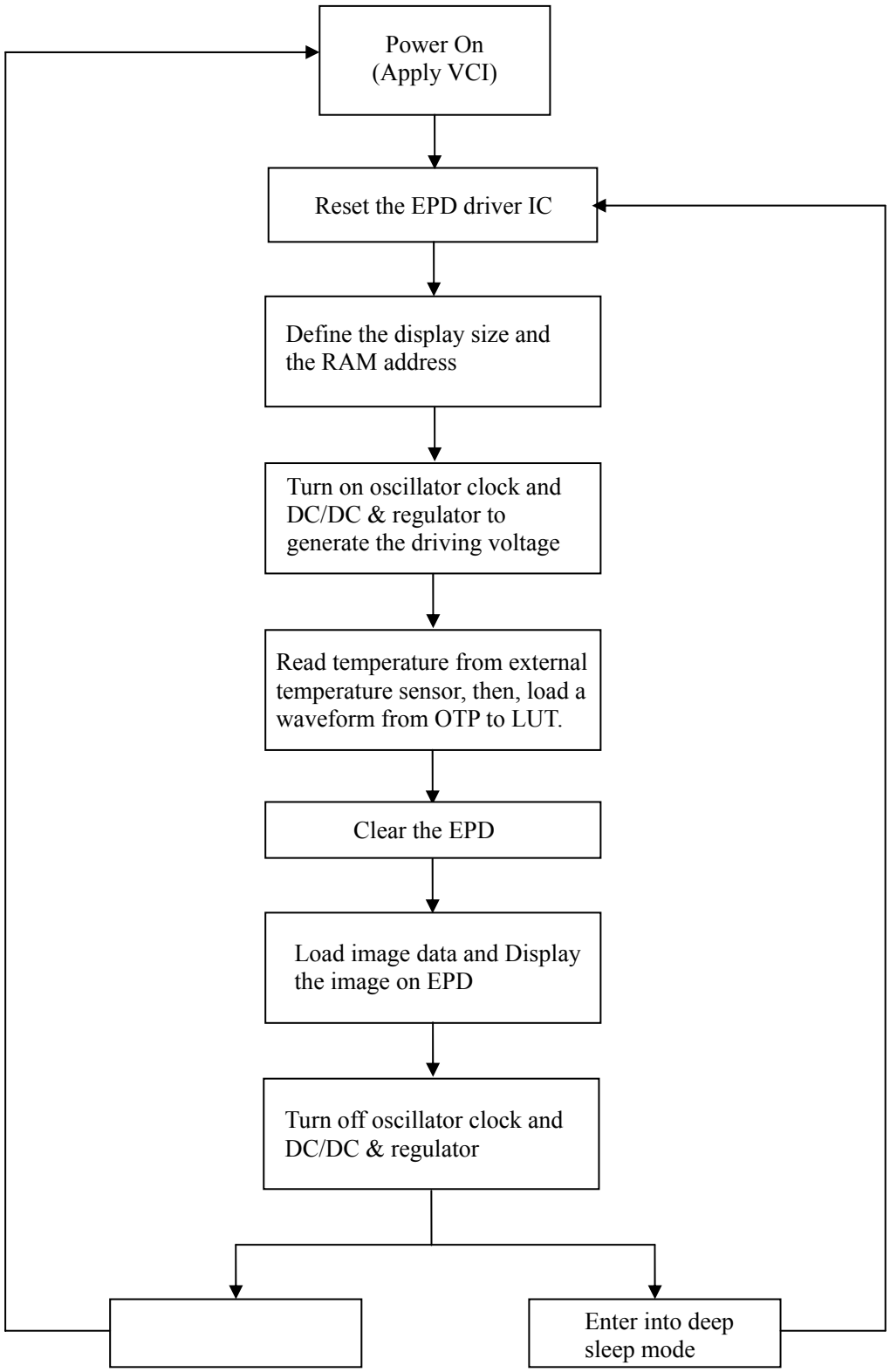



**Figure . 12-4**

# 13 Typical Operating Sequence

## 13.1 Normal Operation Flow



## 13.2 Reference Program Code

**TBD**

# 14 Optical characteristics

## 14.1 Specifications

Measurements are made with that the illumination is under an angle of 45 degrees, the detection is perpendicular unless otherwise specified.

T=25℃

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYPE | MAX | UNIT | Note |
|---|---|---|---|---|---|---|---|
| R | Reflectance | White | 34 | 43 | - | % | Note 9-1 |
| Gn | 2Grey Level | - | - | DS+(WS-DS)xn(m-1) | - | L* | - |
| CR | Contrast Ratio | indoor | - | 10 | - | - | - |
| $T_{update}$ | Update time | 25℃ | - | 600ms | - | ms | - |
| Panel's life | | 0℃~50℃ | | 1000000 times or 5 years | | | Note 9-2 |

WS : White state, DS : Dark state

Gray state from Dark to White : DS、WS

m : 2

Note 9-1 : Luminance meter : Eye – One Pro Spectrophotometer

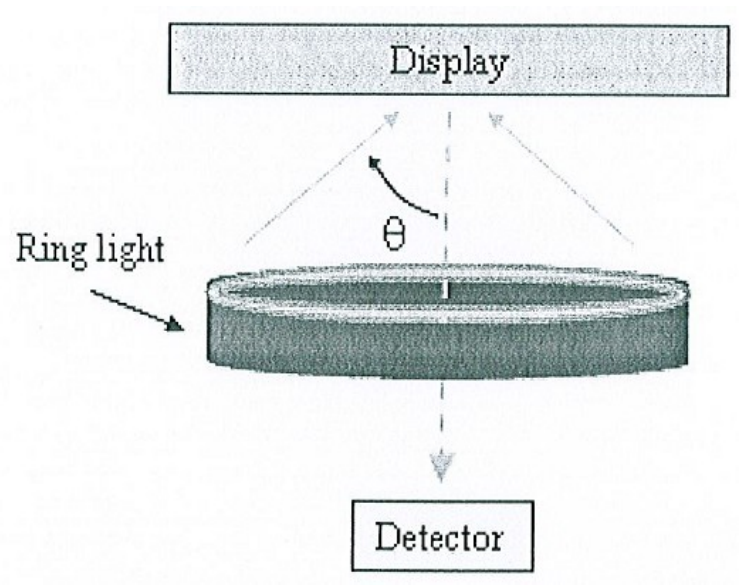
Note 9-2 : When work in temperature below 0 degree or above 50 degree , we do not recommend because the panel's life will not be guaranteed

## 14.2 Definition of contrast ratio

The contrast ratio (CR) is the ratio between the reflectance in a full white area (R1) and the reflectance in a dark area (Rd)() :

R1: white reflectance Rd: dark reflectance

CR = R1/Rd

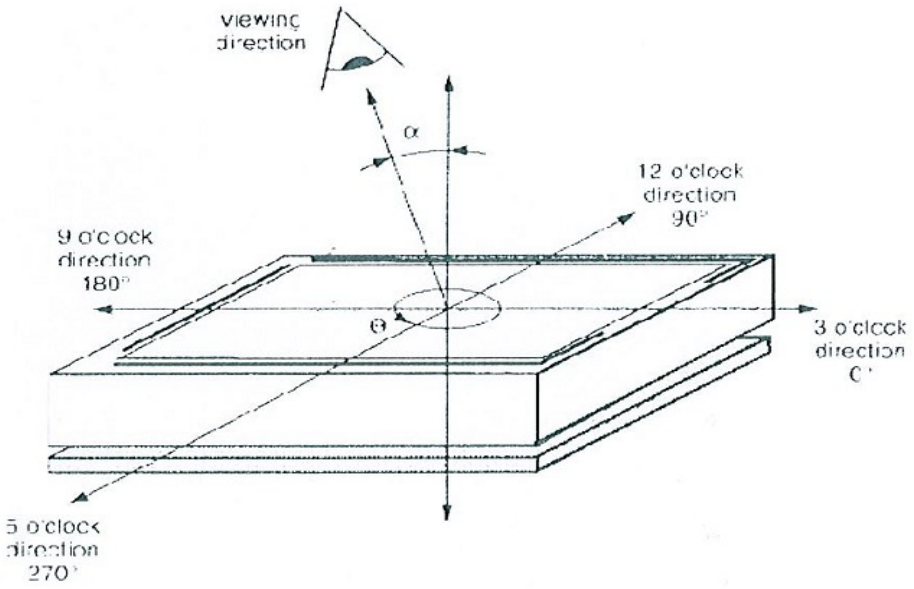


## 14.3 Reflection Ratio

The reflection ratio is expressed as :

R = Reflectance Factor white board x (L center / L white board )

L center is the luminance measured at center in a white area (R=G =B=1) . L white board is the luminance of a standard white board . Both are measured with equivalent illumination source . The viewing angle shall be no more than 2 degrees .




## 14.4 Bi-stability

1. The value of Contrast ratio in different time as follows：

| Bi-stability | Result |
|---|---|
| 250 hours | CR >8 |
| 500 hours | CR >8 |
| 750 hours | CR >7.5 |
| 1000 hours | CR >7 |

# 15 Handling ,Safety and environmental requirements

| WARNING |
|---|
| The display glass may break when it is dropped or bumped on a hard surface . Handle with care.<br>Should the display break, do not touch the electrophoretic material . In case of contact with electrophoretic material , wash with water and soap. |

| CAUTION |
|---|
| The display module should not be exposed to harmful gases , such as acid and alkali gases , which corrode electronic components. |
| Disassembling the display module can cause permanent damage and invalidate the warranty agreements. |

Observe general precautions that are common to handling delicate electronic components . The glass can break and front surfaces can easily be damaged . Moreover the display is sensitive to static electricity and other rough environmental conditions.

| Data sheet status | |
|---|---|
| Product specification | The data sheet contains final product specifications. |
| **Limiting values** | |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134).<br>Stress above one or more of the limiting values may cause permanent damage to the device.<br>These are stress ratings only and operation of the device at these or any other conditions above those given in the Characteristics sections of the specification is not implied . Exposure to limiting values for extended periods may affect device reliability. | |
| **Application information** | |
| Where application information is given , it is advisory and dose not form part of the specification. | |

| Product Environmental certification |
|---|
| ROHS |

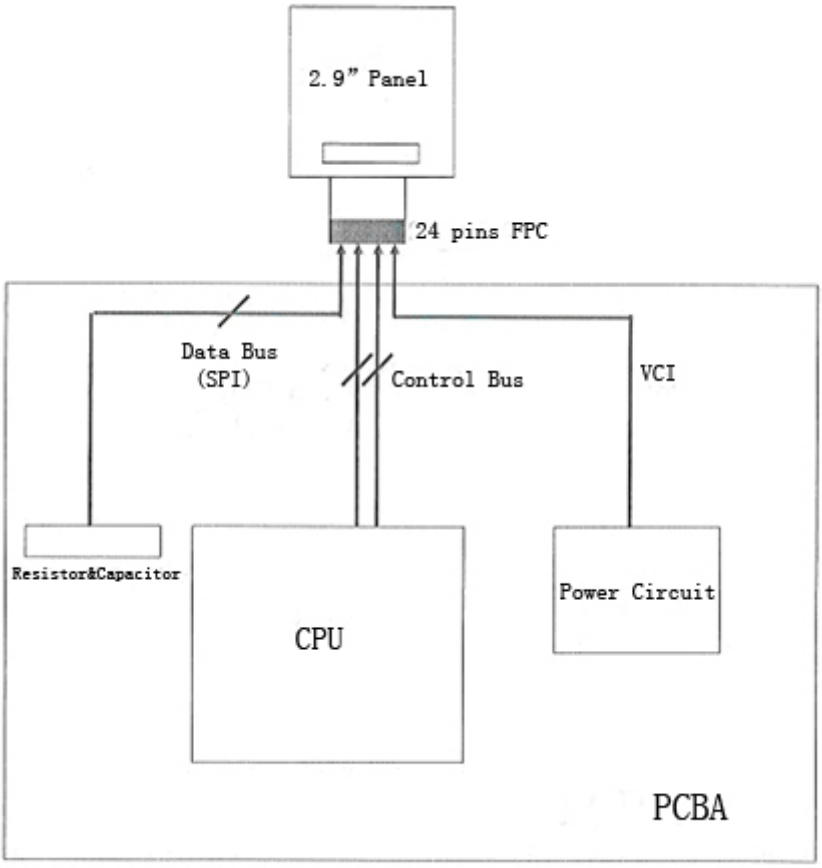
# 16 Reliability test

| | TEST | CONDITION | METHOD | REMARK |
|---|---|---|---|---|
| 1 | High-Temperature Operation | T = 50℃,30% for 240 hrs | IEC 60 068-2-2Bp | |
| 2 | Low-Temperature Operation | T = 0℃ for 240 hrs | IEC 60 068-2-2Ab | |
| 3 | High-Temperature Storage | T = +70℃, 23% for 240 hrs<br>Test in white pattern | IEC 60 068-2-2Bp | |
| 4 | Low-Temperature Storage | T = -25℃ for 240 hrs<br>Test in white pattern | IEC 60 068-2-2Ab | |
| 5 | High Temperature, High-Humidity Operation | T=+40℃,RH=90%for168hrs | IEC 60 068-2-3CA | |
| 6 | High Temperature, High-Humidity Storage | T=+60℃,RH=80%for240hrs<br>Test in white pattern | IEC 60 068-2-3CA | |
| 7 | Temperature Cycle | [-25℃ 30mins]→<br>[+70℃ 30mins]<br>,100cycles<br>Test in white pattern | IEC 60 068-2-14NB | |

Actual EMC level to be measured on customer application.

Note : The protective film must be removed before temperature test.

# 17 Block Diagram



# 18 Point and line standard

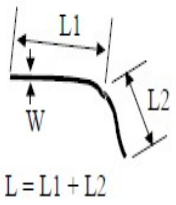
**Shipment Inseption Standard**

Equipment：Electrical test fixture, Point gauge

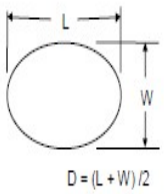
Outline demension：
36.7(H)×79.0(V) ×1.05(D)

Unit：㎜

| Environment | Temperature | Humidity | Illuminance | Distance | Time | Angle |
|---|---|---|---|---|---|---|
| | 19℃～25℃ | 40%～55%RH | 700～1000Lux | 200～400㎜ | 35Sec | |
| appearance standard | Defet type | Inspection | Standard | | Part-A | |
| | dead/ switch point （point overproof） | Electric Display | D≤0.2㎜ | | Ignore | |
| | | | 0.2 ㎜＜D≤0.4 ㎜ | | N≤3 | |
| | | | D＞0.4 ㎜ | | Not Allow | |
| | 2.line (no switch) | Electric Display | L≤0.5mm, to point to determine | | | |
| | | | L≤4W, to point to determine | | | |
| | 3.line （Switching line） | Electric Display | Ignore in gray scale viewing In Blak&white viewing Follow Non-Switching Criteria | | | |
| | 4.Display unwork | Electric Display | Not Allow | | | |
| | 5.Display error | Electric Display | Not Allow | | | |
| | 6. warping | Vsual | T<0.5mm，Ignore； | | | |
| | 7.Protector hurt | Vsual | L≤2㎜，W≤0.05㎜，Ignore； | | | |
| | | | 0.05mm＜W≤01mm，L≤4mm, N≤2 | | | |
| | | | L＞4 ㎜，W＞0.1 ㎜，Not Allow； | | | |
| | 8.PS Bubble | Vsual | D≤0.20mm, Ignore； | | | |
| | | | 0.2mm≤D＜0.35mm & N≤2 | | | |
| | | | D＞0.35 mm，Not Allow； | | | |
| | 9.Packing | Vsual | cannot be dirty and breakdown;must be marked and identified | | | |
| Remark | 1.Cannot be defect&failure cause by appearence defect； | | | | | |
| | 2.Cannot be larger size cause by appearence defect； | | | | | |




Line Defect




Spot Defect

L=long W=wide D=point size

| Edition | Content | Date |
|---|---|---|
| 1 | New edition | Sep.26.2014 |
| | | |
| | | |

# 19 Packing

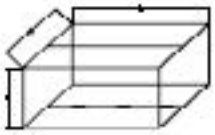
## 包装文件

文件编号:

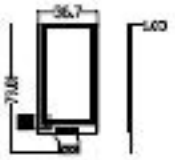
| | 产品型号 | HINK-E029A01-A0 | 拟制日期 | 2015.5.16 | 版本 | A0 | 页码 | 3-1 |
|---|---|---|---|---|---|---|---|---|

一，外包装方式:纸箱

| | |
|---|---|
| 外箱型号 | HINK-E029A01-ZX-A0 |
| 外箱尺寸 | 515*322*170 |
| 产品总数量 | 240 PCS |



产品图纸




二，内包装方式:吸塑

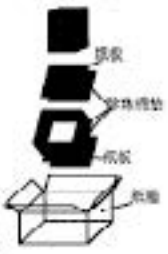
单位，mm

| | | |
|---|---|---|
| 吸塑盒 | 465*280*15 | 13 pcs |
| 防静电铝箔袋<br>吸塑盘珍珠棉垫 | 700*530*0.1<br>408.86*231.6*2 | 1 pcs<br>12 pcs |
| 左右珍珠棉垫 | 485*145*10 | 2 pcs |
| 左右珍珠棉垫 | 285*480*10 | 2 pcs |
| 前后珍珠棉垫 | 310*145*10 | 2 pcs |
| 纸板 | 500*300*5 | 2 pcs |
| 产品数量/盒 | 20 pcs | |
| 盒数/扎 | 12+1 Sheets | |
| 扎数/箱 | 1 | |

步骤一，
材料：吸塑，吸塑盘珍珠棉垫
产品如图示将显示面朝上方向一致放在吸塑盘里面，每盒里面再放上吸防静电塑盘珍珠棉垫。


步骤二，
1），吸塑盒与吸塑盒之间需要旋转180度扣放。
2），每扎放置12层产品，共32*12=384片产品。
3），表层交叉放置1个空吸塑盘

步骤三，
1），在每扎吸塑里面放两袋干燥剂再用胶纸封紧。
2），将封好的吸塑放进铝箔袋中
3），对铝箔袋进行热压封口


步骤四，
1），先将纸板放入纸箱底部再放上天地珍珠棉垫，最后把左右及前后珍珠棉垫放入纸箱的左右前后。
2），将封好的产品放入纸箱里面
3），再装好产品纸箱最上面放上天地珍珠棉垫，再放上纸板，

步骤五，
1），用胶纸将装有产品的纸箱封好。
2），在外箱的外面贴上出货标签，标签不可覆盖安全运输标志及无铅标识。

| 拟制 | 肖忠平 | 审核 | | 批准 | |
|---|---|---|---|---|---|
| 日期 | 2015.5.16 | | | | |

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