# SHENZHEN STARTEK ELECTRONIC TECHNOLOGY CO.,LTD

# SPECIFICATION

# FOR

# LCM Module

| MODULE No: | KD035HVFMD145-01 |
|---|---|
| CUSTOMER: | |

| STARTEK | INITIAL | DATE |
|---|---|---|
| PREPARED BY | | |
| CHECKED BY | | |
| APPROVED BY | | |

| CUSTOMER | INITIAL | DATE |
|---|---|---|
| APPROVED BY | | |

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常 备 库 存　　　　长 期 供 货　　　　支持小量　　　　品 种 齐 全
Stock For Sale　　　Long Time supply　　NO MOQ　　　In Full Range

# SHENZHEN STARTEK ELECTRONIC TECHNOLOGY CO.,LTD

## Revision History

| Date | Rev. No. | Page | Summary |
|---|---|---|---|
| 2020.09.07 | V1.0 | ALL | FIRST ISSUE |
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常 备 库 存　　　　长 期 供 货　　　　支持小量　　　　品 种 齐 全
Stock For Sale　　　Long Time supply　　　NO MOQ　　　In Full Range

# SHENZHEN STARTEK ELECTRONIC TECHNOLOGY CO.,LTD

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| 常 备 库 存<br>Stock For Sale | | 长 期 供 货<br>Long Time supply | 支持小量<br>NO MOQ | 品 种 齐 全<br>In Full Range |

## * Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This module is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 3.47'TFT-LCD contains 320x480 pixels, and can display up to 65K/262K colors.
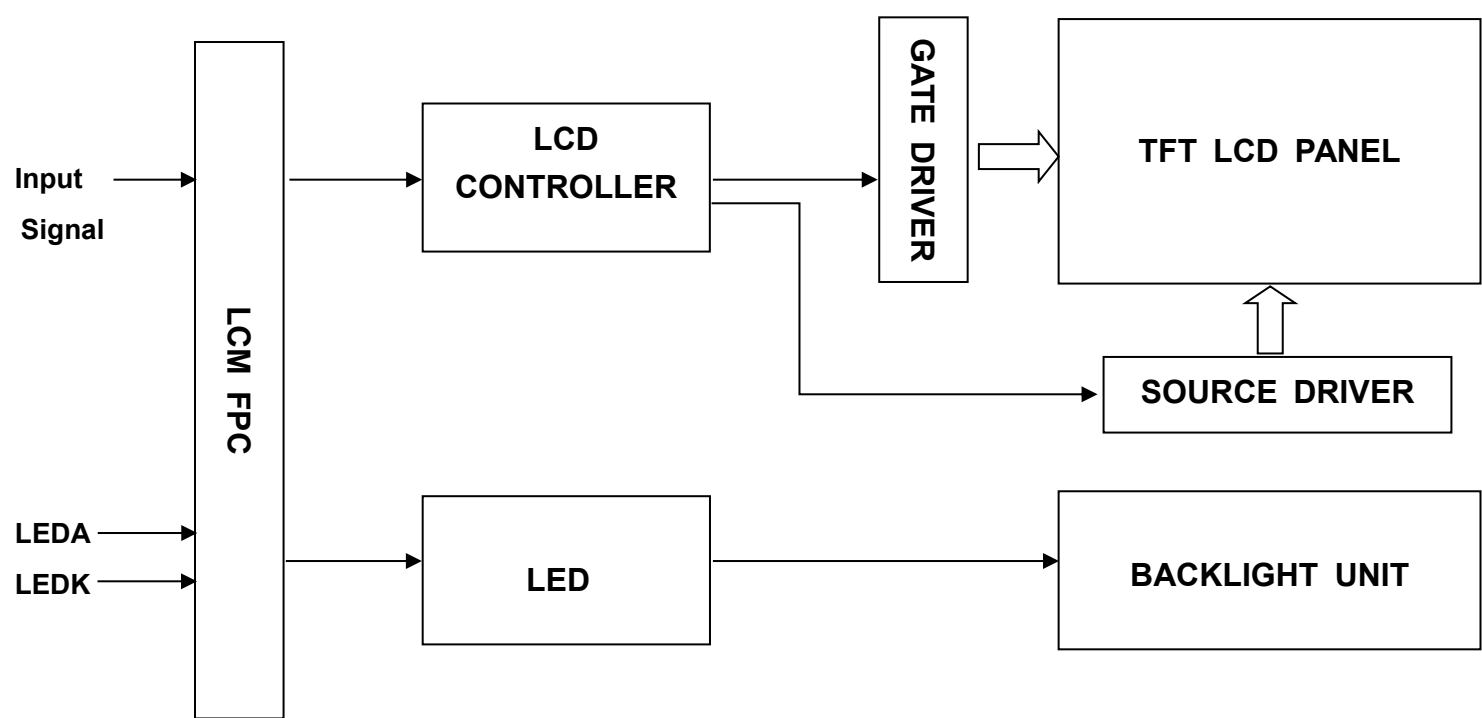
## * Features

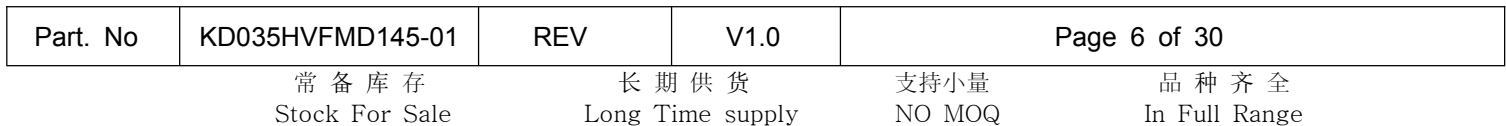| General Information Items | Specification | Unit | Note |
|---|---|---|---|
| | Main Panel | | |
| Display area(AA) | 48.96(H)*73.44（V）  (3.47inch) | mm | - |
| Driver element | TFT active matrix | - | - |
| Display colors | 65K/262K | colors | - |
| Number of pixels | 320(RGB)*480 | dots | - |
| Pixel arrangement | RGB vertical stripe | - | - |
| Pixel pitch | 0.153(H)*0.153(V) | mm | - |
| Viewing angle | ALL | o'clock | - |
| Controller IC | ST7796 | - | - |
| LCM Interface | 8/9/16/18BIT  MCU  Interface<br>3/4SPI+16/18Bit  RGB  Interface<br>3-line/4-line  serial  interface | | |
| Display mode | Transmissive/ Normally Black | - | - |
| Operating temperature | -20～+70 | ℃ | - |
| Storage temperature | -30～+80 | ℃ | - |

## * Mechanical Information

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module size | Horizontal(H) | | 54.58 | | mm | - |
| | Vertical(V) | | 83.57 | | mm | - |
| | Depth(D) | | 2.2 | | mm | - |
| Weight | | | 20 | | g | - |

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常 备 库 存　　　　长 期 供 货　　　　支持小量　　　　品 种 齐 全
Stock For Sale　　Long Time supply　　NO MOQ　　In Full Range

# 1. Block Diagram

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| --- | --- | --- | --- | --- |

| 常 备 库 存 | 长 期 供 货 | 支持小量 | 品 种 齐 全 |
| --- | --- | --- | --- |
| Stock For Sale | Long Time supply | NO MOQ | In Full Range |

## 2. Outline dimension

注：上机壳开窗须小于 LCD POL 0.3mm以上，LCD V.A为上镜片建议开窗区．

未标注尺寸以CAD为准

Rear View

Rear View

Side View

Front View

FPC bending diagram.
Product FPc unfold shipment

BACK

FRONT

LED(B/L) CIRCUIT

NOTES:
1. DISPLAY TYPE: 3.47", TFT-LCD, 65K/262K COLORS
2. DISPLAY MODE: IPS NORMALLY BLACK
3. VIEWING DIRECTION: ALL
4. DRIVER IC: ST7796 (COG)
5. VCI: 3.3V,IOVCC:1.8~3.3V
6. OPERATING TEMP: -20℃ TO 70℃
7. STORAGE TEMP: -30℃ TO 80℃
7. BACK LIGHT: LED WHITE, 10 LED, 40mA, 16V±0.3V
8. RoHS COMPLIANT.

| IM2 | IM1 | IM0 | Interface type | DB Pin in use |
|---|---|---|---|---|
| 0 | 0 | 0 | DBI Type_18bit interface | DB17~DB0 |
| 0 | 0 | 1 | DBI Type_9bit interface | DB8~DB0 |
| 0 | 1 | 0 | DBI Type_16bit interface | DB15~DB0 |
| 0 | 1 | 1 | DBI Type_18bit interface | DB17~DB0 |
| 1 | 0 | 1 | 3-wire 9 BIT data serial interface | SDI SCL CS |
| 1 | 1 | 1 | 4-wire 8 BIT data select serial interface | SDI SCL CS RS |

NOTE:
1.If not use PIN,fix to the GND ,VCI or NC.
2.If use RGB interface must select serial interface

| XO. | Pin Name |
|---|---|
| 1 | GND |
| 2 | IOVCC |
| 3 | VCI |
| 4 | IM0 |
| 5 | IM1 |
| 6 | IM2 |
| 7 | RESX |
| 8 | VSYNC |
| 9 | HSYNC |
| 10 | PCLK |
| 11 | DE |
| 12 | DB17R5_MSb |
| 13 | DB16R4 |
| 14 | DB15R3 |
| 15 | DB14R2 |
| 16 | DB13R1 |
| 17 | DB12R0LSb |
| 18 | DB11G5_MSb |
| 19 | DB10G4 |
| 20 | DB09G3 |
| 21 | DB08G2 |
| 22 | DB07G1 |
| 23 | DB06G0LSb |
| 24 | DB05B5_MSb |
| 25 | DB04B4 |
| 26 | DB03B3 |
| 27 | DB02B2 |
| 28 | DB01B1 |
| 29 | DB00B0LSb |
| 30 | DOUT |
| 31 | DIN_SDA |
| 32 | RDX |
| 33 | WRX_SCL |
| 34 | DCX |
| 35 | CSX |
| 36 | TE |
| 37 | XR(NC) |
| 38 | YD(NC) |
| 39 | XL(NC) |
| 40 | YU(NC) |
| 41 | NC |
| 42 | LEDK |
| 43 | LEDA |
| 44 | NC |
| 45 | GND |

| ReV | Revision content description | Date |
|---|---|---|
|  | First Issue | 2020.08.31 |

深圳市柯达科电子科技有限公司
SHENZHEN STARTEK ELECTRONICS CO.,LTD

DRAWING NAME: KD035HVFMD145-01
PARTS NO. 990351511D

Drawn
Checked
Approve

TOLERANCE(公差)
TOLERANCE UNLESS X.X±0.3
OTHERWISE SPECIFIED X.XX±0.2

Scale 1:1

Unit mm
Page 1/1

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常 备 库 存　　　　长 期 供 货　　　　支持小量　　　　品 种 齐 全
Stock For Sale　　　Long Time supply　　　NO MOQ　　　In Full Range

# 3. Input terminal Pin Assignment

| NO. | SYMBOL | DISCRIPTION | | | | | | I/O |
|---|---|---|---|---|---|---|---|---|
| 1 | GND | Ground. | | | | | | P |
| 2 | IOVCC | Supply voltage for IO(1.8-3.3V) | | | | | | P |
| 3 | VCI | Supply voltage(3.3V). | | | | | | P |
| 4 | IM0 | IM2 | IM1 | IM0 | Interface type | | DB Pin in use | I |
| 5 | IM1 | 0 | 0 | 0 | DBI Tyb_ 18-bit interface | | DB17-DB0 | |
| | | 0 | 0 | 1 | DBI Tyb_ 9-bit interface | | DB8-DB0 | |
| | | 0 | 1 | 0 | DBI Tyb_ 16-bit interface | | DB15-DB0 | |
| 6 | IM2 | 0 | 1 | 1 | DBI Tyb_ 8-bit interface | | DB7-DB0 | |
| | | 1 | 0 | 1 | 3-Wire 9 BIT data serial interface | | SDA SCL CS | |
| | | 1 | 1 | 1 | 4-Wire 8 BIT data serial interface | | SDA SCL CS RS | |
| 7 | RESX | - This signal will reset the device and it must be applied to properly initialize the chip.<br>- Signal is active low. | | | | | | I |
| 8 | VSYNC | Frame synchronizing signal for RGB interface operation.<br>fix this pin at VCI or GND when not in use. | | | | | | I |
| 9 | HSYNC | Line synchronizing signal for RGB interface operation.<br>fix this pin at VCI or GND when not in use | | | | | | I |
| 10 | PCLK | Dot clock signal for RGB interface operation<br>Fix this pin at VCI or GND when not in use. | | | | | | I |
| 11 | DE | Data enable signal for RGB interface operation.<br>fix this pin at VCI or GND when not in use. | | | | | | I |
| 12-29 | DB17-DB0 | 18-bit parallel bi-directional data bus for MCU system and RGB interface mode .<br>Fix to GND level when not in use | | | | | | I/O |
| 30 | DOUT | - SPI interface output pin.<br>- The data is outputted on the falling edge of the SCL signal.<br>- If not used, please fix this pin at floating. | | | | | | O |
| 31 | DIN_SDA | - SPI interface input/output pin.<br>- The data is latched on the rising edge of the SCL signal.<br>- If not used, please fix this pin GND level. | | | | | | I |
| 32 | RDX | - Read enable in 8080 MCU parallel interface. Low-active.<br>- If not used, please fix this pin GND level. | | | | | | I |

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|---|---|---|---|---|

| 33 | WR(SPI-SCL) | - Write enable in MCU parallel interface.<br>- In SPI mode, this pin is used as SCL.<br>- If not used, please fix this pin GND level. | I |
|---|---|---|---|
| 34 | DCX | -Display data/command selection (RS) pin in MCU interface.<br>DCX='1': display data or parameter.<br>DCX='0': register index / command.<br>- If not used, please fix this pin at GND level. | I |
| 35 | CSX | Chip select input pin ("Low" enable).<br>fix this pin at VCI or GND when not in use. | I |
| 36 | TE | Serve as a TE (Tearing Effect) output signal<br>Leave the pin open when not in use | O |
| 37 | XR(NC) | Touch panel Right Glass Terminal | A/D |
| 38 | YD(NC) | Touch panel Bottom Film Terminal | A/D |
| 39 | XL(NC) | Touch panel LEFT Glass Terminal | A/D |
| 40 | YU(NC) | Touch panel Top Film Terminal | A/D |
| 41 | NC | NC | |
| 42 | LEDK | Cathode pin OF backlight | P |
| 43 | LEDA | Anode pin of backlight | P |
| 44 | NC | NC | |
| 45 | GND | Ground. | P |

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| 常 备 库 存<br>Stock For Sale | 长 期 供 货<br>Long Time supply | 支持小量<br>NO MOQ | 品 种 齐 全<br>In Full Range |
|---|---|---|---|

## 4. LCD Optical Characteristics

### 4.1 Optical specification

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit. | Note |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio | | CR | $\Theta=0$ | 900 | 1000 | -- | | (1)(2) |
| Response time | Rising | $T_R+T_F$ | Normal viewing angle | -- | 30 | 40 | msec | |
| | Falling | | | | | | | (1)(3) |
| Color Gamut | | S(%) | | 60 | 65 | -- | % | |
| Color Filter Chromacicity | White | $W_X$ | | 0.2494 | 0.2894 | 0.3294 | | (1)(4) CF glass |
| | | $W_Y$ | | 0.2919 | 0.3319 | 0.3719 | | |
| | Red | $R_X$ | | 0.5815 | 0.6215 | 0.6615 | | |
| | | $R_Y$ | | 0.3071 | 0.3471 | 0.3871 | | |
| | Green | $G_X$ | | 0.2616 | 0.3016 | 0.3416 | | |
| | | $G_Y$ | | 0.6183 | 0.5783 | 0.6183 | | |
| | Blue | $B_X$ | | 0.1076 | 0.1476 | 0.1876 | | |
| | | $B_Y$ | | 0.0110 | 0.0510 | 0.0910 | | |
| Viewing angle | Hor. | $\Theta L$ | CR>10 | 70 | 80 | -- | | |
| | | $\Theta R$ | | 70 | 80 | -- | | |
| | Ver. | $\Theta U$ | | 70 | 80 | -- | | |
| | | $\Theta D$ | | 70 | 80 | -- | | |
| Option View Direction | | | ALL | | | | | |

*The data comes from the LCD specification.

**Measuring Condition**

Measuring surrounding : dark room

Ambient temperature : $25\pm2_oC$

15min. warm-up time.

**Measuring Equipment**

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

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| 常 备 库 存 | 长 期 供 货 | 支持小量 | 品 种 齐 全 |
|---|---|---|---|
| Stock For Sale | Long Time supply | NO MOQ | In Full Range |

**Note (1):** Definition of Viewing Angle :
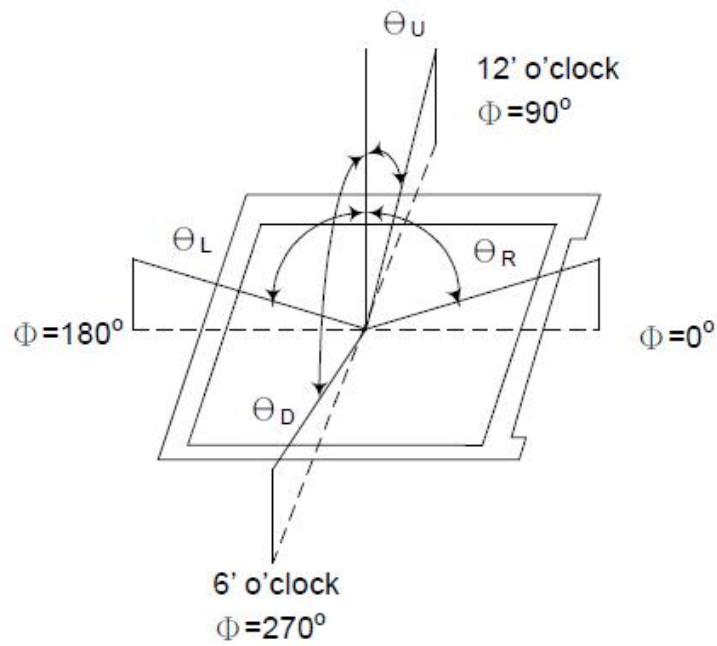


**Note (2):** Definition of Contrast Ratio(CR) :measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

**Note (3):** Response Time



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|----------|------------------|-----|------|---------------|
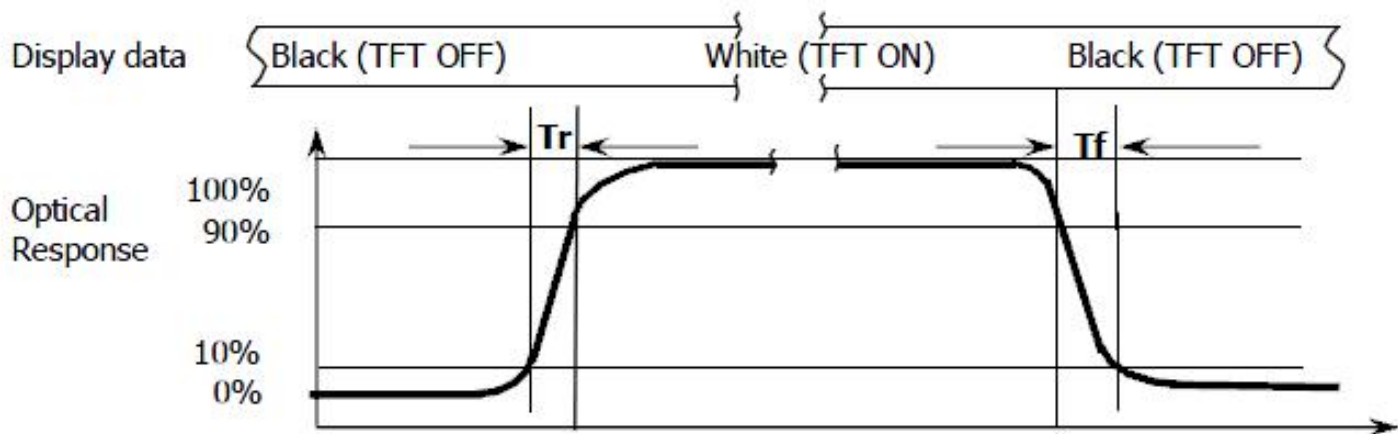
**Note (4):** Definition of optical measurement setup

Photo-detector (BM-5A)

50cm

Field=1°

Center of panel

LCD panel

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|----------|------------------|-----|------|---------------|
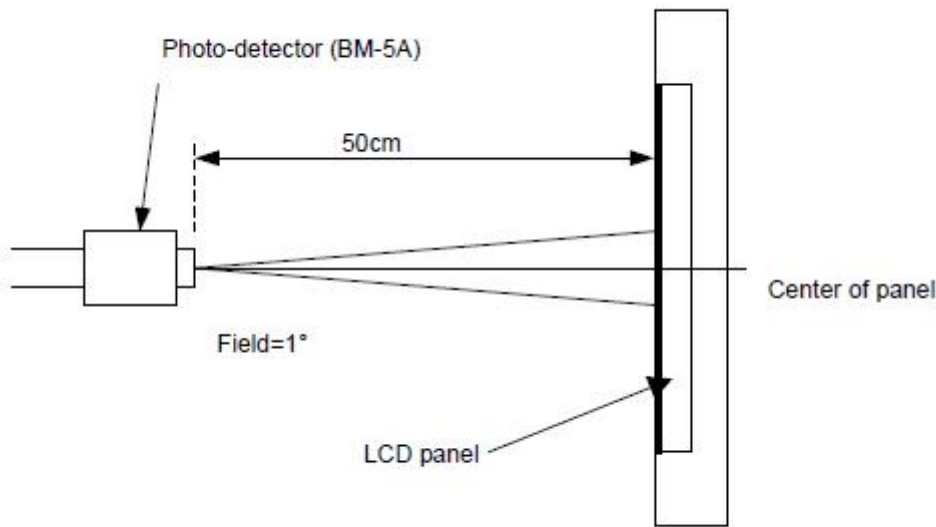
# 5. Electrical Characteristics

## 5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

| Characteristics | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Digital Supply Voltage | VCI | -0.3 | 4.6 | **V** |
| Digital interface supple Voltage | IOVCC | -0.3 | 4.6 | **V** |
| Operating temperature | $T_{OP}$ | -20 | +70 | ℃ |
| Storage temperature | $T_{ST}$ | -30 | +80 | ℃ |

NOTE:   If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

## 5.2 DC Electrical Characteristics

| Characteristics | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Digital Supply Voltage | VCI | 2.5 | 3.3 | -- | V | |
| Digital interface supple Voltage | IOVCC | 1.65 | 1.8 | 3.3 | V | |
| Normal mode Current consumption | IDD | -- | 15 | 30 | mA | |
| Level input voltage | $V_{IH}$ | 0.7IOVCC | | IOVCC | V | |
| | $V_{IL}$ | GND | | 0.3IOVCC | V | |
| Level output voltage | $V_{OH}$ | 0.8IOVCC | | IOVCC | V | |
| | $V_{OL}$ | GND | | 0.2IOVCC | V | |

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常 备 库 存　　　　长 期 供 货　　　　支持小量　　　　品 种 齐 全
Stock For Sale　　Long Time supply　　NO MOQ　　In Full Range

## 5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 10 chips White LED

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Forward Current | $I_F$ | 30 | 40 | -- | mA | |
| Forward Voltage | $V_F$ | -- | 16 | -- | V | |
| LCM Luminance | $L_V$ | 900 | 950 | -- | cd/m2 | Note3 |
| LED life time | Hr | 50000 | -- | -- | Hour | Note1,2 |
| Uniformity | AVg | 80 | -- | -- | % | Note3 |

Note (1)    LED life time (Hr) can be defined as the time in which it continues to operate under the condition:

Ta=25±3 ℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2)    The "LED life time" is defined as the module brightness decrease to 50% original brightness at

Ta=25℃ and IL=40mA. The LED lifetime could be decreased if operating IL is larger than 40mA. The

constant current driving method is suggested.

A    K

LED(B/L) CIRCUIT

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|---|---|---|---|---|
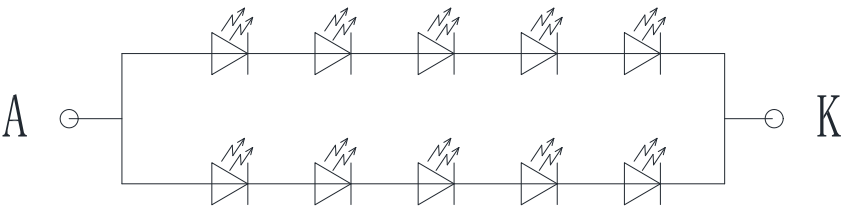
NOTE 3：Luminance Uniformity of these 9 points is defined as below:
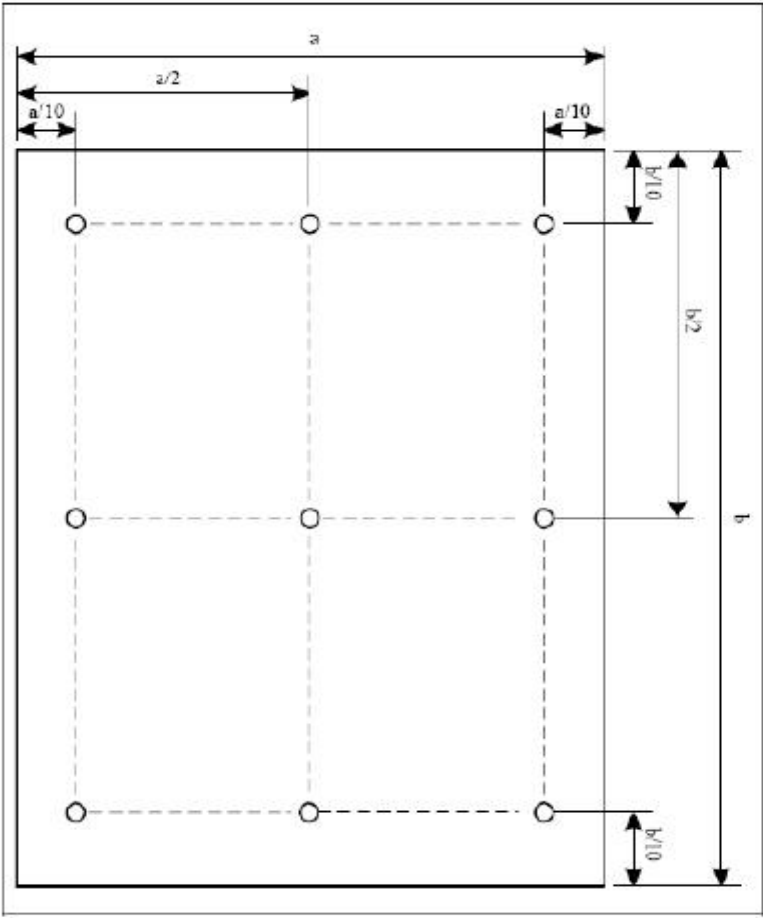


$$Uniformity = \frac{minimum\ luminance\ in\ 9\ points\ (1-9)}{maximum\ luminance\ in\ 9\ points\ (1-9)}$$

$$Luminance = \frac{Total\ Luminance\ of\ 9\ points}{9}$$

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# 6. AC Characteristics

## 6.1 8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus
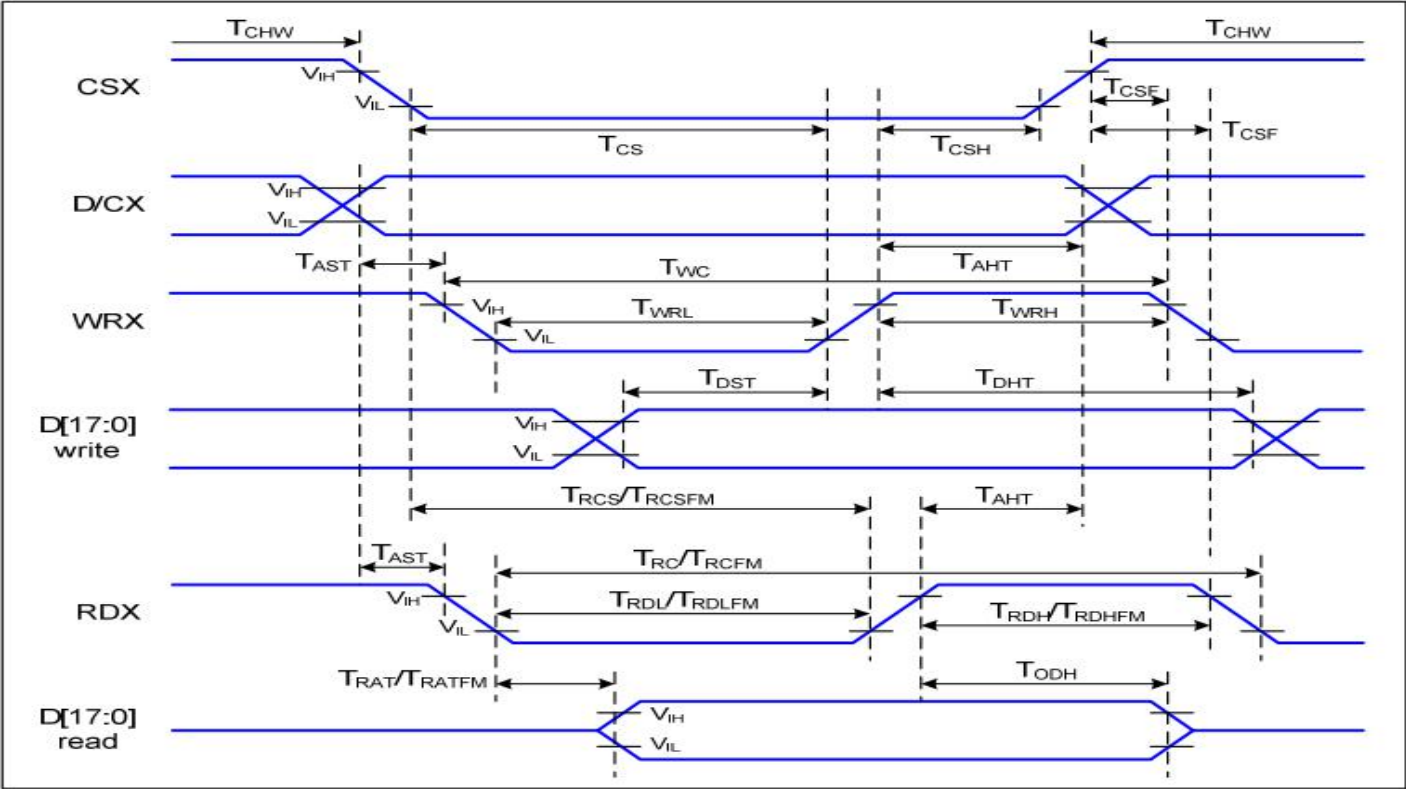


Parallel Interface Timing Characteristics (8080-Series MCU Interface)

VDDI=1.8V,VDDA=2.8V, AGND=DGND=0V, Ta=25 ℃

| Signal | Symbol | Parameter | Min | Max | Unit | Description |
|---|---|---|---|---|---|---|
| D/CX | $T_{AST}$ | Address setup time | 0 | | ns | - |
| | $T_{AHT}$ | Address hold time (Write/Read) | 10 | | ns | |
| CSX | $T_{CHW}$ | Chip select "H" pulse width | 0 | | ns | - |
| | $T_{CS}$ | Chip select setup time (Write) | 15 | | ns | |
| | $T_{RCS}$ | Chip select setup time (Read ID) | 45 | | ns | |
| | $T_{RCSFM}$ | Chip select setup time (Read FM) | 355 | | ns | |
| | $T_{CSF}$ | Chip select wait time (Write/Read) | 10 | | ns | |
| | $T_{CSH}$ | Chip select hold time | 10 | | ns | |
| WRX | $T_{WC}$ | Write cycle | 66 | | ns | |
| | $T_{WRH}$ | Control pulse "H" duration | 15 | | ns | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | $T_{WRL}$ | Control pulse "L" duration | 15 | | ns | |
| RDX (ID) | $T_{RC}$ | Read cycle (ID) | 160 | | ns | When read ID data |
| | $T_{RDH}$ | Control pulse "H" duration (ID) | 90 | | ns | |
| | $T_{RDL}$ | Control pulse "L" duration (ID) | 45 | | ns | |
| RDX (FM) | $T_{RCFM}$ | Read cycle (FM) | 450 | | ns | When read from frame memory |
| | $T_{RDHFM}$ | Control pulse "H" duration (FM) | 90 | | ns | |
| | $T_{RDLFM}$ | Control pulse "L" duration (FM) | 355 | | ns | |
| D[17:0] | $T_{DST}$ | Data setup time | 10 | | ns | For CL=30pF |
| | $T_{DHT}$ | Data hold time | 10 | | ns | |
| | $T_{RAT}$ | Read access time (ID) | - | 40 | ns | |
| | $T_{RATFM}$ | Read access time (FM) | - | 340 | ns | |
| | $T_{ODH}$ | Output disable time | 20 | 80 | ns | |

8080 Parallel Interface Characteristics
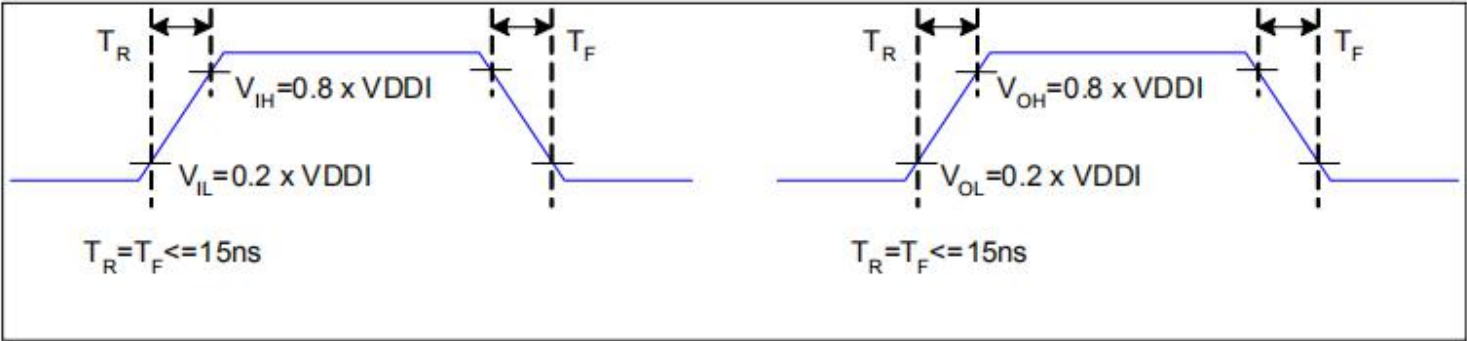


Rising and Falling Timing for I/O Signal

Note: The rising time and falling time (Tr, Tf) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 20% and 80% of VDDI for Input signals.

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常 备 库 存　　　　　长 期 供 货　　　　　支持小量　　　　　品 种 齐 全
Stock For Sale　　　Long Time supply　　　NO MOQ　　　In Full Range

## 6.2 3-SPI Serial Data Transfer Interface Characteristics:



3-SPI Interface Timing Characteristics
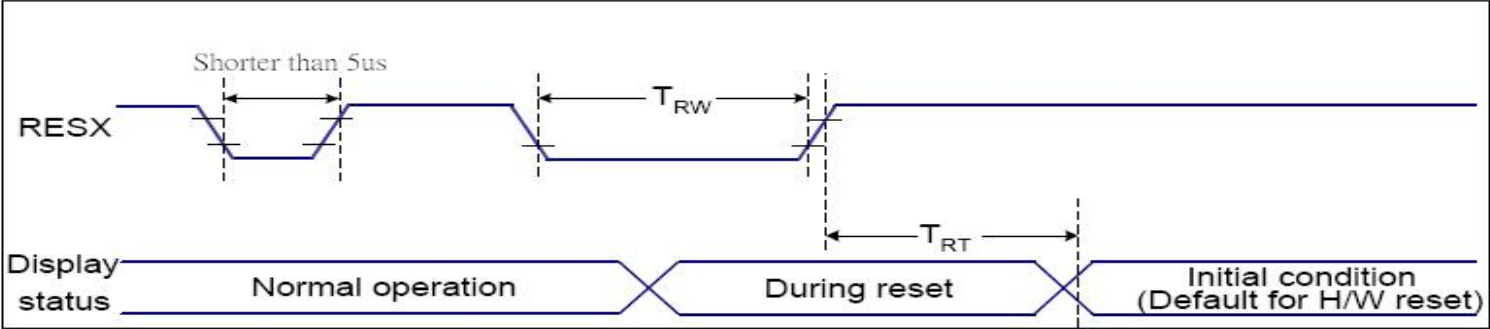
VDDI=1.8V,VDDA=2.8V, AGND=DGND=0V, Ta=25 ℃

| Signal | Symbol | Parameter | Min | Max | Unit | Description |
|---|---|---|---|---|---|---|
| CSX | $T_{CSS}$ | Chip select setup time (write) | 15 | | ns | |
| | $T_{CSH}$ | Chip select hold time (write) | 15 | | ns | |
| | $T_{CSS}$ | Chip select setup time (read) | 60 | | ns | |
| | $T_{SCC}$ | Chip select hold time (read) | 65 | | ns | |
| | $T_{CHW}$ | Chip select "H" pulse width | 40 | | ns | |
| SCL | $T_{SCYCW}$ | Serial clock cycle (Write) | 66 | | ns | |
| | $T_{SHW}$ | SCL "H" pulse width (Write) | 15 | | ns | |
| | $T_{SLW}$ | SCL "L" pulse width (Write) | 15 | | ns | |
| | $T_{SCYCR}$ | Serial clock cycle (Read) | 150 | | ns | |
| | $T_{SHR}$ | SCL "H" pulse width (Read) | 60 | | ns | |
| | $T_{SLR}$ | SCL "L" pulse width (Read) | 60 | | ns | |
| SDA (DIN) | $T_{SDS}$ | Data setup time | 10 | | ns | |
| | $T_{SDH}$ | Data hold time | 10 | | ns | |
| DOUT | $T_{ACC}$ | Access time | 10 | 50 | ns | For maximum CL=30pF |
| | $T_{OH}$ | Output disable time | 15 | 50 | ns | For minimum CL=8pF |

3-SPI Interface Characteristics

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|---|---|---|---|---|

## 6.3 4-SPI Serial Data Transfer Interface Characteristics:



4-SPI Interface Timing Characteristics

VDDI=1.8V,VDDA=2.8V, AGND=DGND=0V, Ta=25 ℃

| Signal | Symbol | Parameter | MIN | MAX | Unit | Description |
|---|---|---|---|---|---|---|
| CSX | $T_{CSS}$ | Chip select setup time (write) | 15 | | ns | |
| | $T_{CSH}$ | Chip select hold time (write) | 15 | | ns | |
| | $T_{CSS}$ | Chip select setup time (read) | 60 | | ns | |
| | $T_{SCC}$ | Chip select hold time (read) | 65 | | ns | |
| | $T_{CHW}$ | Chip select "H" pulse width | 40 | | ns | |
| SCL | $T_{SCYCW}$ | Serial clock cycle (Write) | 66 | | ns | -write command & data ram |
| | $T_{SHW}$ | SCL "H" pulse width (Write) | 15 | | ns | |
| | $T_{SLW}$ | SCL "L" pulse width (Write) | 15 | | ns | |
| | $T_{SCYCR}$ | Serial clock cycle (Read) | 150 | | ns | -read command & data ram |
| | $T_{SHR}$ | SCL "H" pulse width (Read) | 60 | | ns | |
| | $T_{SLR}$ | SCL "L" pulse width (Read) | 60 | | ns | |
| D/CX | $T_{DCS}$ | D/CX setup time | 10 | | ns | |
| | $T_{DCH}$ | D/CX hold time | 10 | | ns | |
| SDA (DIN) | $T_{SDS}$ | Data setup time | 10 | | ns | |
| | $T_{SDH}$ | Data hold time | 10 | | ns | |
| DOUT | $T_{ACC}$ | Access time | 10 | 50 | ns | For maximum CL=30pF |
| | $T_{OH}$ | Output disable time | 15 | 50 | ns | For minimum CL=8pF |

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|---|---|---|---|---|

## 6.4 RGB Interface Characteristics:
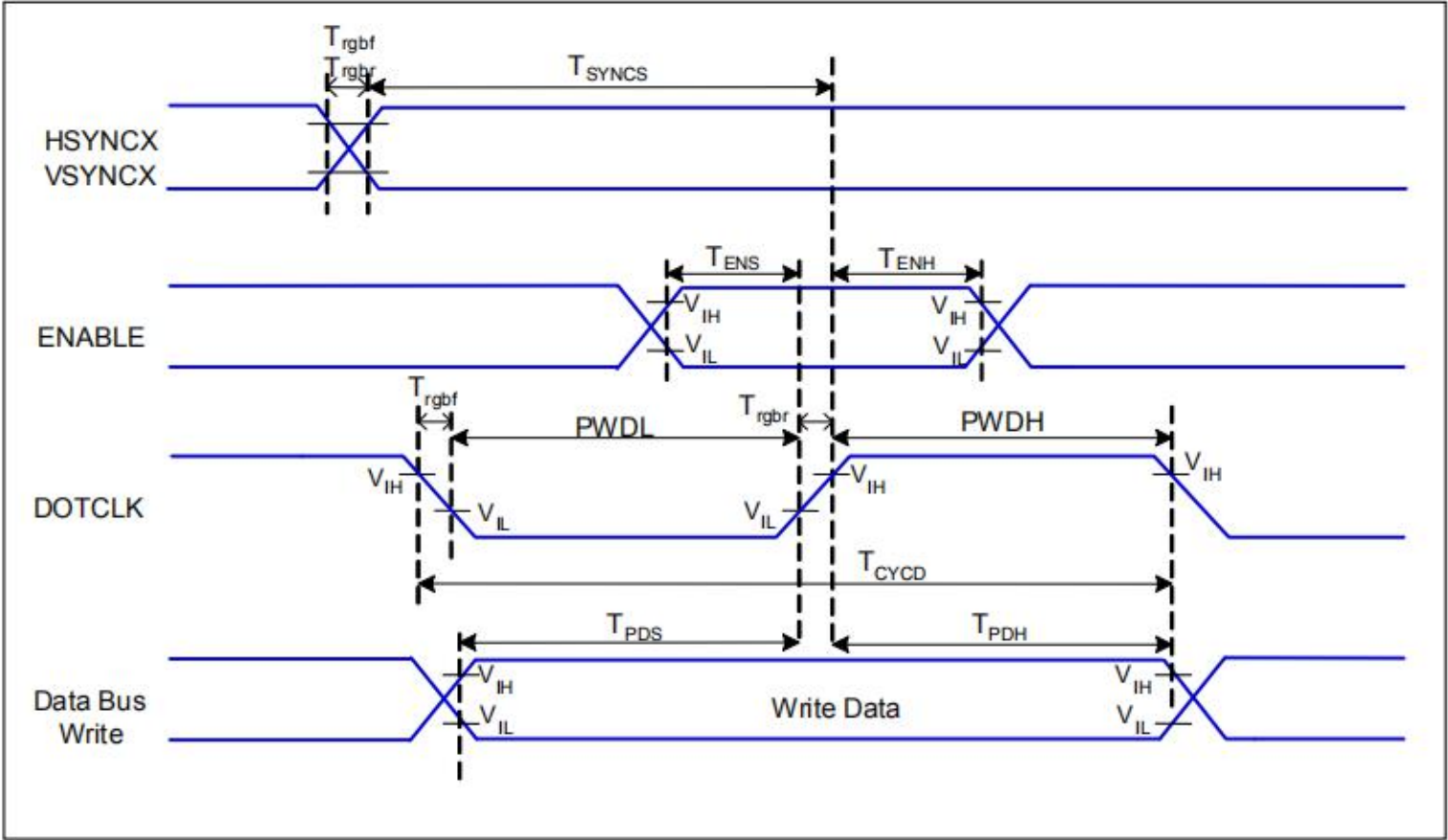


*VDDI=1.8V,VDDA=2.8V, AGND=DGND=0V, Ta=25℃*

| Signal | Symbol | Parameter | MIN | MAX | Unit | Description |
|--------|--------|-----------|-----|-----|------|-------------|
| HSYNC, VSYNC | $T_{SYNCS}$ | VSYNC, HSYNC Setup Time | 15 | - | ns | |
| ENABLE | $T_{ENS}$ | Enable Setup Time | 15 | - | ns | |
| | $T_{ENH}$ | Enable Hold Time | 15 | - | ns | |
| DOTCLK | PWDH | DOTCLK High-level Pulse Width | 30 | - | ns | |
| | PWDL | DOTCLK Low-level Pulse Width | 30 | - | ns | |
| | $T_{CYCD}$ | DOTCLK Cycle Time | 66 | - | ns | |
| | Trghr, Trghf | DOTCLK Rise/Fall time | - | 15 | ns | |
| DB | $T_{PDS}$ | PD Data Setup Time | 15 | - | ns | |
| | $T_{PDH}$ | PD Data Hold Time | 15 | - | ns | |

RGB Interface Timing Characteristics

| Part. No | KD035HVFMD145-01 | REV | V1.0 | Page 19 of 30 |
|----------|------------------|-----|------|---------------|

**6.5 Reset timing**



VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 ~ 70 ℃

| Related Pins | Symbol | Parameter | MIN | MAX | Unit |
|---|---|---|---|---|---|
| RESX | TRW | Reset pulse duration | 10 | - | us |
| | TRT | Reset cancel | - | 5 (Note 1, 5) | ms |
| | | | | 120 (Note 1, 6, 7) | ms |

Notes:

1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

| RESX Pulse | Action |
|---|---|
| Shorter than 5us | Reset Rejected |
| Longer than 9us | Reset |
| Between 5us and 9us | Reset starts |

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:

常 备 库 存　　　　　长 期 供 货　　　　　支持小量　　　　　品 种 齐 全
Stock For Sale　　　Long Time supply　　　NO MOQ　　　In Full Range

10μs

Reset is accepted

10μs

20ns — Less than 20ns width positive spike will be rejected.
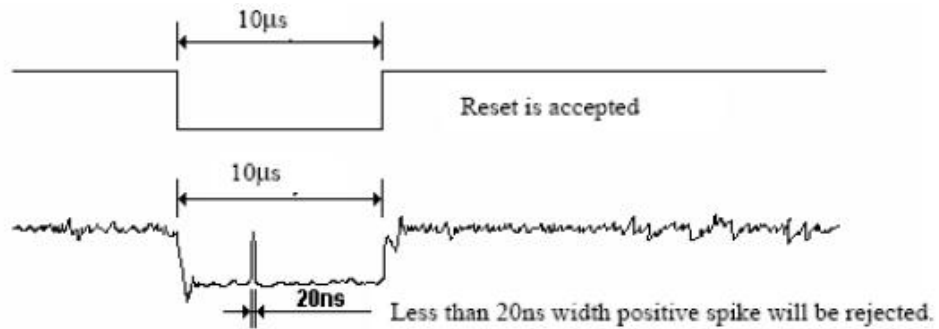
5. When Reset applied during Sleep In Mode.

6. When Reset applied during Sleep Out Mode.

7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

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|----------|------------------|-----|------|---------------|

| 常 备 库 存<br>Stock For Sale | 长 期 供 货<br>Long Time supply | 支持小量<br>NO MOQ | 品 种 齐 全<br>In Full Range |
|---|---|---|---|

# 7. LCD Module Out-Going Quality Level

## 7.1 VISUAL & FUNCTION INSPECTION STANDARD

### 7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

Temperature：25±5℃

Humidity： 65%±10%RH

Viewing Angle：Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm
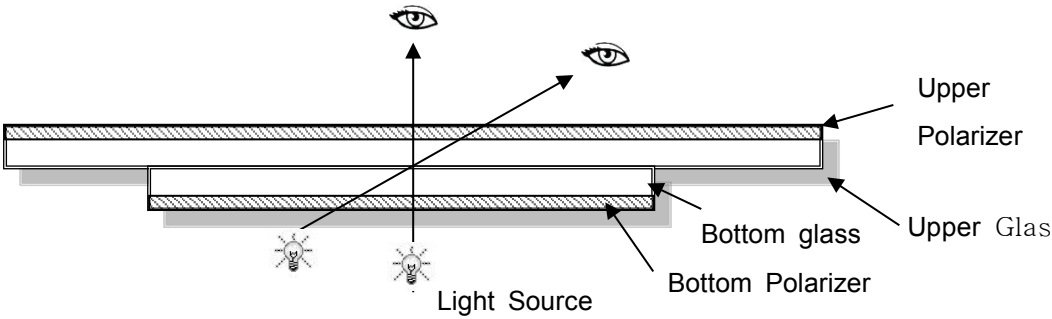
### 7.1.2 Definition
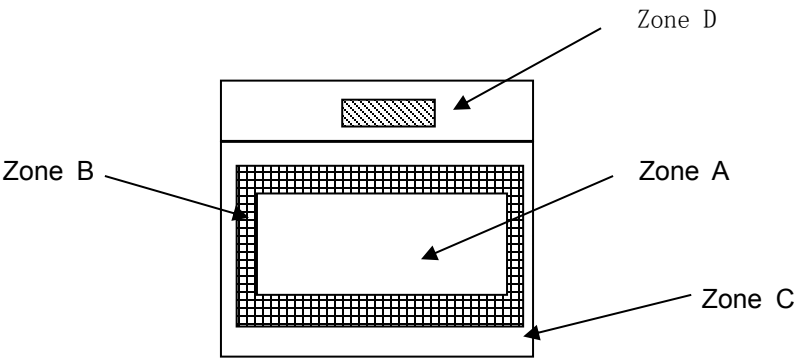
Zone A：Effective Viewing Area(Character or Digit can be seen)

Zone B：Viewing Area except Zone A

Zone C：Outside (Zone A+Zone B) which can not be seen after assembly by customer

Zone D：IC Bonding Area

Note:As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

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|---|---|---|---|---|

## 7.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class Ⅱ

AQL:

| Major defect | Minor defect |
|---|---|
| 0.65 | 1.5 |
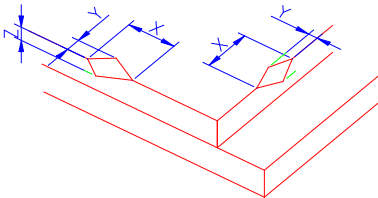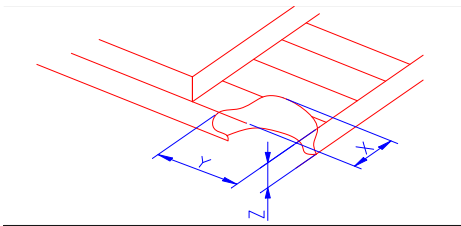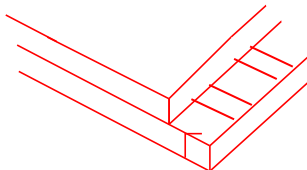
LCD: Liquid Crystal Display , LCM: Liquid Crystal Module,

| No | Items to be inspected | Criteria | Classification of defects |
|---|---|---|---|
| 1 | Functional defects | 1) No display, Open or miss line<br>2) Display abnormally, Short<br>3) Backlight no lighting, abnormal lighting. etc… | Major |
| 2 | Missing | Missing components and etc… | |
| 3 | Outline dimension | Overall outline dimension beyond the drawing is not allowed,deformation and etc… | |
| 4 | Color tone | Color unevenness, refer to limited sample | Minor |
| 5 | Spot/Line defect | Light dot,Dim spot,(Note1)<br>Polarizer Air Bubble,<br>Polarizer accidented spot and etc. | |
| 6 | Soldering appearance | Good soldering , Peeling off is not allowed and etc. | |
| 7 | LCD/Polarizer | Black/White spot/line, scratch, crack, etc. | |

**Note1:** a) Light dot：Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

| Part. No | KD035HVFMD145-01 | REV | V1.0 | Page 23 of 30 |
|---|---|---|---|---|

| 常 备 库 存 | 长 期 供 货 | 支持小量 | 品 种 齐 全 |
|---|---|---|---|
| Stock For Sale | Long Time supply | NO MOQ | In Full Range |

**7.1.4 Criteria (Visual)**

| Number | Items | Criteria(mm) |
|---|---|---|
| 1.0　LCD Crack/Broken<br>NOTE:<br>X: Length<br>Y: Width<br>Z: Height<br>L: Length of ITO,<br>T: Height of LCD | (1) The edge of LCD broken | <br><table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td>&lt;Inner border line of the seal</td><td>≤T</td></tr></table> |
| | (2)LCD corner broken | <br><table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table> |
| | (3) LCD crack | <br>Crack<br>Not　allowed |

| Part. No | KD035HVFMD145-01 | REV | V1.0 | Page 24 of 30 |
|---|---|---|---|---|

常 备 库 存　　　　长 期 供 货　　　　支持小量　　　　品 种 齐 全
Stock For Sale　　　Long Time supply　　　NO MOQ　　　In Full Range

| 2.0 | Spot defect $\Phi=(X+Y)/2$ | |
|---|---|---|

① light dot（ black/white spot，pinhole, stain，etc.)

| Size (mm) \ Zone | Acceptable Qty | | |
|---|---|---|---|
| | A | B | C |
| Φ≤0.15 | Ignore | | |
| 0.15<Φ≤0.25 | 3(distance≧10mm) | Ignore | |
| 0.25<Φ≤0.4 | 2(distance≧10mm) | | |
| Φ>0.4 | 0 | | |

② Dim spot（light leakage、dent、dark spot，etc)
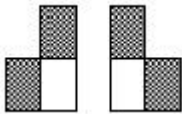
| Size (mm) \ Zone | Acceptable Qty | | |
|---|---|---|---|
| | A | B | C |
| Φ≤0.15 | Ignore | | |
| 0.15<Φ≤0.25 | 3( distance≧10mm) | Ignore | |
| 0.25<Φ≤0.4 | 2( distance≧10mm) | | |
| Φ>0.4 | 0 | | |

③ Polarizer accidented spot

| Size (mm) \ Zone | Acceptable Qty | | |
|---|---|---|---|
| | A | B | C |
| Φ≤0.2 | Ignore | | |
| 0.2<Φ≤0.5 | 2( distance≧10mm) | | Ignore |
| Φ>0.5 | 0 | | |

④Polarizer Bubble

| Size (mm) \ Zone | Acceptable Qty | | |
|---|---|---|---|
| | A | B | C |
| Φ≤0.2 | Ignore | | |
| 0.2<Φ≤0.4 | 3(distance≧10mm) | | Ignore |
| Φ>0.4 | 0 | | |

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|---|---|---|---|---|

| 3.0 | LCD Pixel defect | Pixel bad points |

| Item | Zone A | | Acceptable Qt |
|------|--------|---|---------------|
| Bright dot | Random | | N≤2 |
| | 2 dots adjacent | | N≤0 |
| | 3 dots adjacent | | N≤0 |
| Dark dot | Random | | N≤2 |
| | 2 dots adjacent | | N≤0 |
| | 3 dots adjacent | | N≤0 |
| Distance | 1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot. | | 5mm |
| Total bright and dark dot | | | N≤4 |

Note:

A) Bright dot：Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

C) 2 dot adjacent = 1 pair = 2 dots

Picture:

2 dot adjacent                    2 dot adjacent

2 dot adjacent (vertical)         2 dot adjacent (slant)

| 常 备 库 存 Stock For Sale | 长 期 供 货 Long Time supply | 支持小量 NO MOQ | 品 种 齐 全 In Full Range |

| 4.0 | Line defect (LCD /Polarizer backlight black/white line, scratch, stain)  W: width, L : length N：Count | | | | | |
|---|---|---|---|---|---|---|

| Width(mm) | Length(mm) | Acceptable Qty | | |
|---|---|---|---|---|
| | | A | B | C |
| Φ≤0.05 | Ignore | Ignore | | Ignore |
| 0.05<W≤0.06 | L≤4.0 | N≤3 | | |
| 0.06<W≤0.08 | L≤3.0 | N≤2 | | |
| W>0.08 | Define as spot defect | | | |

| 5.0 | Electronic Components SMT. | Not allow missing parts，solderless connection，cold solder joint，mismatch，The positive and negative polarity opposite |
|---|---|---|
| 6.0 | Display color& Brightness. | 1.  Color：Measuring the color coordinates, The measurement standard according to the datasheet or samples. <br> 2.  Brightness：Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples. |
| 7.0 | LCD Mura/Waving/ Hot spot | Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary. |

Criteria ( functional items)

| Number | Items | Criteria (mm) |
|---|---|---|
| 1 | No display | Not allowed |
| 2 | Missing segment | Not allowed |
| 3 | Short | Not allowed |
| 4 | Backlight no lighting | Not allowed |

| Part. No | KD035HVFMD145-01 | REV | V1.0 | Page 27 of 30 |
|---|---|---|---|---|

## 8. Reliability Test Result

| Item | Condition | Inspection after test |
|---|---|---|
| High Temperature Operating | 70℃,96H | Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value. |
| Low Temperature Operating | -20℃, 96HR | |
| High Temperature Storage | 80℃, 96HR | |
| Low Temperature Storage | -30℃, 96HR | |
| High Temperature & High Humidity Operating | +60℃, 90% RH ,96 hours. | |
| Thermal Shock (Non-operation) | -10℃,30 min ↔ +60℃,30 min, Change time:5min 20CYC. | |
| ESD test | C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±6KV, 5 times; (Environment: 15℃~35℃, 30%~60%). | |
| Vibration (Non-operation) | Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition). | |
| Box Drop Test | 1 Corner 3 Edges 6 faces,80㎝(MEDIUM BOX) | |

Remark:

1.The test samples should be applied to only one test item.

2.Sample size for each test item is 5~10pcs.

3.For Damp Proof Test, Pure water(Resistance＞10MΩ) should be used.

4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

6. The color fading mura of polarizing filter should not care.

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|---|---|---|---|---|

常 备 库 存　　　　　长 期 供 货　　　　　支持小量　　　　　品 种 齐 全
Stock For Sale　　　Long Time supply　　　NO MOQ　　　In Full Range

# 9. Cautions and Handling Precautions

## 9.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.

Do not warp or twist the module during assembly work.

(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.

(4) Do not allow drops of water or chemicals to remain on the display surface.

If you have the droplets for a long time, staining and discoloration may occur.

(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.

Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static; it may cause damage to the CMOS ICs.

(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(12) Pins of I/F connector shall not be touched directly with bare hands.

(13) Do not connect, disconnect the module in the "Power ON" condition.

(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence &6.2 Power Off Sequence

## 9.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.

It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%

(2) Do not store the TFT-LCD module in direct sunlight.

(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.

(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.

In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

# 10. Packing

| 常 备 库 存 | 长 期 供 货 | 支持小量 | 品 种 齐 全 |
|---|---|---|---|
| Stock For Sale | Long Time supply | NO MOQ | In Full Range |