StarFive 赛昉科技

# Using an LED Dot Matrix with VisionFive 2

with Python

Application Note

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# Preface

About this guide and technical support information.

## About this document

This application note provides steps to use VisionFive 2's GPIO pins to make a MAX7219 Serial Dot Matrix display with StarFive logo through an example program with Python.

## Revision History

**Table 0-1 Revision History**

| Version | Released | Revision |
|---|---|---|
| 1.0 | 2022/11/30 | The first official release. |

## Notes and notices

The following notes and notices might appear in this guide:

- **Tip:**
  Suggests how to apply the information in a topic or step.
- **Note:**
  Explains a special case or expands on an important point.
- **Important:**
  Points out critical information concerning a topic or step.
- **CAUTION:**
  Indicates that an action or step can cause loss of data, security problems, or performance issues.
- **Warning:**
  Indicates that an action or step can result in physical harm or cause damage to hardware.

# Contents

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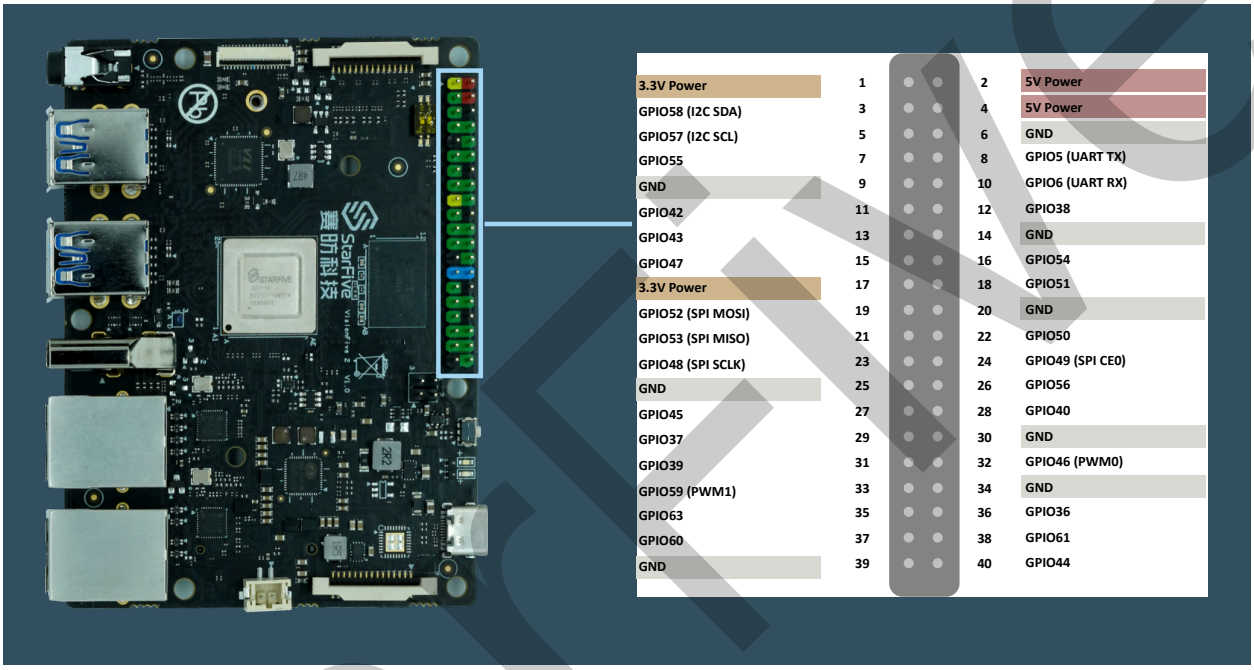
# 1. Introduction

This application note provides steps to use VisionFive 2's GPIO pins to make a MAX7219 Serial Dot Matrix display with StarFive logo through an example program with Python.

## 1.1. 40-Pin Header Definition

The following figure shows the location of the 40-pin header on VisionFive 2.

**Figure 1-1 40-Pin Definition**



# 2. Preparation

Before executing the demo program, make sure you prepare the following:

## 2.1. Environment Requirements

The environment requirements are as follows:

- Linux Kernel: Linux 5.15
- OS: Debian 12
- SBC: VisionFive 2
- SoC: JH7110

## 2.2. Preparing Hardware

Prepare the following hardware items before running the demo code:

**Table 2-1 Hardware Preparation**

| Type | M/O* | Item | Notes |
|---|---|---|---|
| General | M | VisionFive 2 single board computer | - |
| General | M | • 32 GB (or more) micro-SD card<br>• micro-SD card reader<br>• Computer (Windows/macOS/Linux)<br>• USB to serial converter (3.3 V I/O)<br>• Ethernet cable<br>• Power adapter (5 V / 3 A)<br>• USB Type-C Cable | These items are used for flashing Debian OS into a micro-SD card. |
| GPIO Demo (LED Matrix) | M | MAX7219 Serial Dot Matrix Display Module (with a 5-way female to female Dupont cable) | - |

**Note:**
*: M: Mandatory, O: Optional

### 2.2.1. Hardware Setup

The following table and figure describe how to connect MAX7219 to the 40-pin GPIO header:

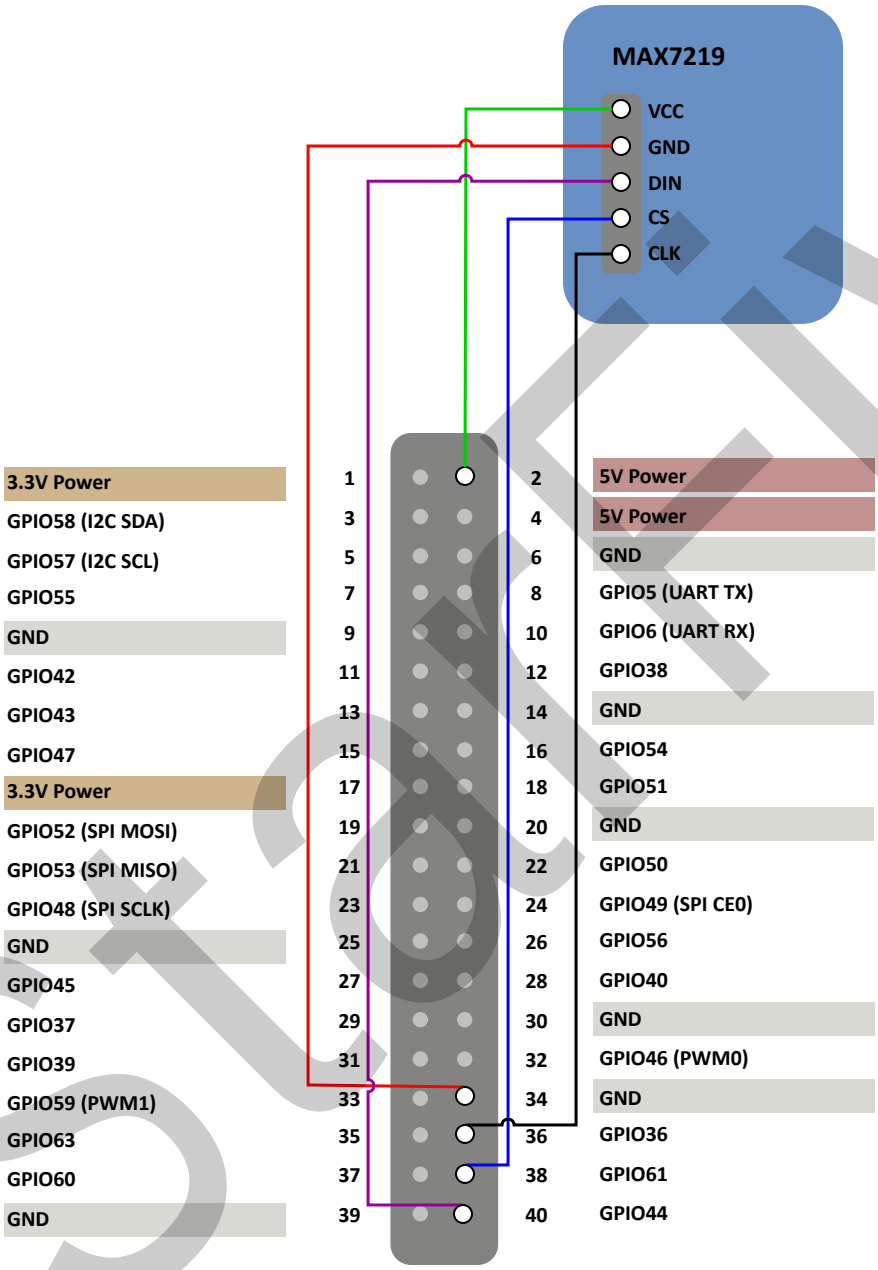
**Table 2-2 Connect MAX7219 to the 40-Pin Header**

| MAX7219 | 40-Pin GPIO Header | |
|---|---|---|
| | Pin Number | Pin Name |
| VCC | 2 | 5V Power |
| GND | 34 | GND |
| DIN | 40 | GPIO44 |

**Table 2-2 Connect MAX7219 to the 40-Pin Header (continued)**

| MAX7219 | 40-Pin GPIO Header | |
|---|---|---|
| | Pin Number | Pin Name |
| CS | 38 | GPIO61 |
| CLK | 36 | GPIO36 |

**Figure 2-1 Connect MAX7219 to the 40-Pin Header**




## 2.3. Preparing Software

Make sure the following procedures are performed:

**Note:**
The Python project, `VisionFive.gpio`, is applicable for VisionFive, VisionFive 2, and JH7110 EVB.

1. Flash Debian OS into a Micro-SD card as described in the *Flashing OS to a Micro-SD Card* section in the *VisionFive 2 Single Board Computer Quick Start Guide*.
2. Log into the Debian and make sure VisionFive 2 is connected to the Internet. For detailed instructions, refer to the *Using SSH over Ethernet* or *Using a USB to Serial Converter* section in the *VisionFive 2 Single Board Computer Quick Start Guide*.
3. Extend the partition on Debian as described in *Extend Partition* in the *VisionFive 2 Single Board Computer Quick Start Guide*.
4. Execute the following command to install PIP on Debian:

   ```
   apt-get install python3-pip
   ```

5. Execute the `pip` command on VisionFive 2 Debian to install the `VisionFive.gpio` package:

   ```
   sudo pip install VisionFive.gpio
   ```

   Alternatively, you can execute the following command:

   ```
   sudo pip3 install VisionFive.gpio
   ```

6. (Optional) If you copy the source code to the local directory under VisionFive 2 Debian, execute the following commands under the source code directory:

   **Tip:**
   The source code can be downloaded by clicking the following link: VisionFive.gpio.

   ```
   sudo apt-get install python3-dev
   sudo python setup.py install
   ```

   Alternatively, you can execute the following command:

   ```
   sudo python3 setup.py install
   ```

# 3. Running Demo Code

To run the demo code, perform the following on VisionFive 2 Debian:

1. Locate to the directory where the test code, `LED_Matrix.py`, exists:

    a. Execute the following command to get the directory where `VisionFive.gpio` exists:

    ```
    pip show VisionFive.gpio
    ```

    **Example Result:**

    ```
    Location: /usr/local/lib64/python3.9/site-packages
    ```

    **Note:**

    The actual output depends on how the application is installed.

    b. Execute the following to enter the directory, for example, `/usr/local/lib64/python3.9/site-packages` as indicated in the previous step output:

    ```
    cd /usr/local/lib64/python3.9/site-packages
    ```

    c. Execute the following command to enter the `sample-code` directory:

    ```
    cd ./VisionFive/sample-code/
    ```

2. Under the `sample-code` directory, execute the following command to run the demo code:

    ```
    sudo python LED_Matrix.py
    ```

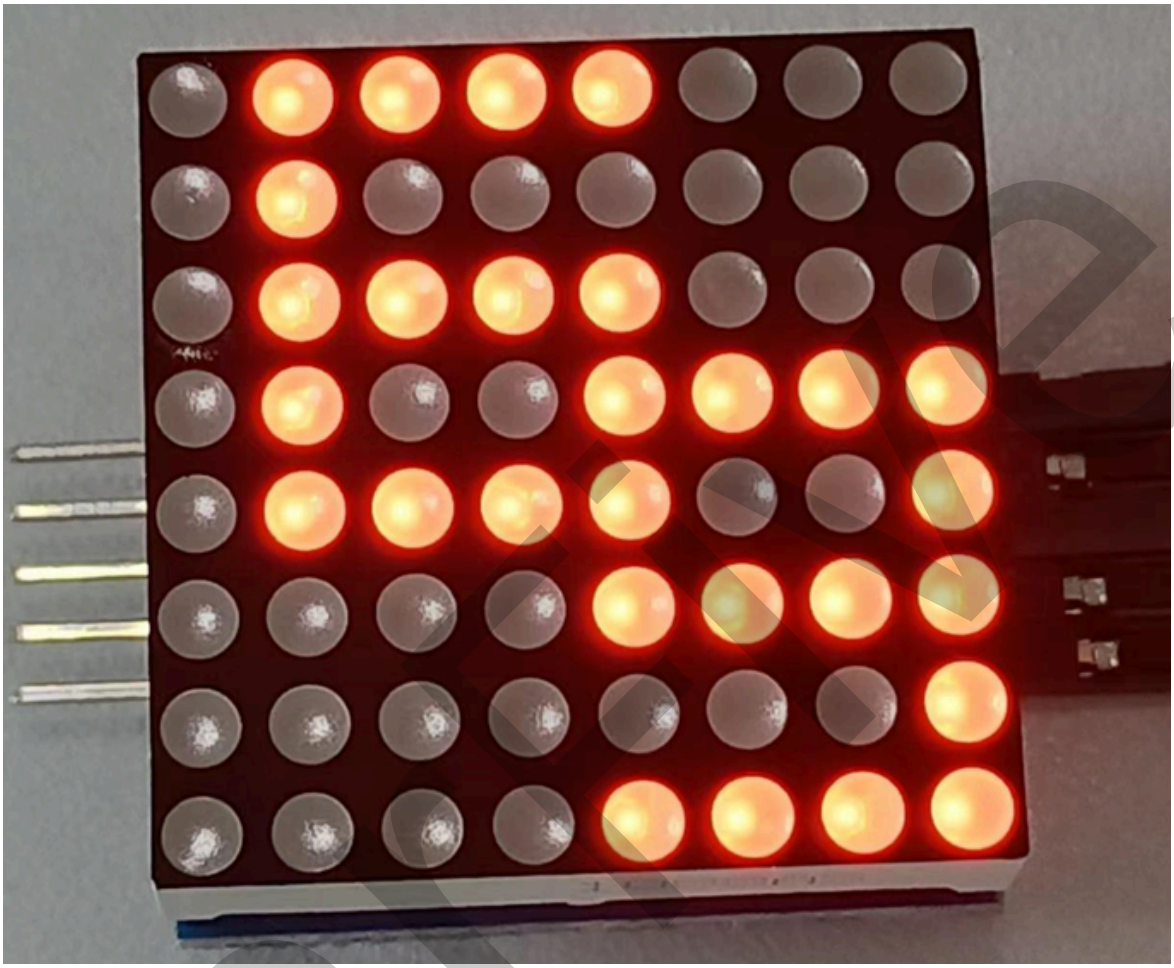
    Alternatively, you can execute the following command:

    ```
    sudo python3 LED_Matrix.py
    ```

    **Result:**

The Led Matrix module displays with the StarFive logo.

**Figure 3-1 Example Output**



# 4. Demo Source Code

The Python source code of this demo is provided for reference purpose only.

`LED_Matrix.py`:

```
'''
Please make sure the LED Dot Matrix is connected to the correct pins.
The following table describes how to connect LED Dot Matrix to the 40-pin header.
----------------------------------------
___MAX7219_______Pin Number_____Pin Name
    VCC             2           5V Power
    GND             34           GND
    DIN             40          GPIO44
    CS              38          GPIO61
    CLK             36          GPIO36
----------------------------------------
'''

import VisionFive.gpio as GPIO
import sys
import time

DIN = 40
CS  = 38
CLK = 36
#Configure the direction of DIN, CS, and CLK as out.
GPIO.setup(DIN, GPIO.OUT)
GPIO.setup(CS, GPIO.OUT)
GPIO.setup(CLK, GPIO.OUT)

#Display logo data.
buffer = ['01111000', '01000000', '01111000', '01001111', '01111001', '00001111', '00000001', '00001111']

#LED turn off data.
buffer_off = ['0', '0', '0', '0', '0', '0', '0', '0']

def sendbyte(bytedata):
    for bit in range(0, 8):
        if ((bytedata << bit) & 0x80):
            GPIO.output(DIN, GPIO.HIGH)
        else:
            GPIO.output(DIN, GPIO.LOW)

        #Configure the voltage level of CLK as high.
        GPIO.output(CLK, GPIO.HIGH)
        #Configure the voltage level of CLK as low.
        GPIO.output(CLK, GPIO.LOW)


def WriteToReg(regaddr, bytedata):
    #Configure the voltage level of cs as high.
    GPIO.output(CS, GPIO.HIGH)
    #Configure the voltage level of led_pin as low.
    GPIO.output(CS,GPIO.LOW)
    GPIO.output(CLK, GPIO.LOW)
    sendbyte(regaddr)
    sendbyte(bytedata)
    GPIO.output(CS, GPIO.HIGH)

def WriteALLReg():
    time.sleep(0.1)
    for i in range(0, 8):
        #Write data to register address. Finally the LED matrix displays StarFive logo.
        WriteToReg(i+1, int(buffer[i], 2))
    time.sleep(5)

    #Display logo.
    for i in range(0, 10):
        for j in range(0, 8):
```

```
            #Write data to the register address. Finally turn off the LED matrix.
            WriteToReg(j+1, int(buffer_off[j], 2))
        time.sleep(0.1)
        for j in range(0, 8):
            #Write data to the register address. Finally the LED matrix displays with StarFive logo.
            WriteToReg(j+1, int(buffer[j], 2))
        time.sleep(0.1)

def initData():
    WriteToReg(0x09, 0x00) #Set the decode mode.
    WriteToReg(0x0a, 0x03) #Set the brightness.
    WriteToReg(0x0b, 0x07) #Set the scan limitation.
    WriteToReg(0x0c, 0x01) #Set the power mode.
    WriteToReg(0x0f, 0x00)

def main():
    initData()
    while True:
        WriteALLReg()

if __name__ == "__main__":
    sys.exit(main())
```