StarFive
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Using an LED Dot Matrix with VisionFive 2

with Python

Application Note

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Legal Statements

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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
1.2	GPIO to Make	Updated the Linux and OS version in Environment Requirements *(on page 8)*. Updated the steps in Preparing Software *(on page 9)*. Updated the steps in Running Demo Code *(on page 12)*.
1.1	2023/06/08	• Added a note in 40-Pin GPIO Header Definition *(on page 7)*. • Updated the method for installing `VisionFive.gpio` package in Preparing Software *(on page 9)*. • Added Resources *(on page 16)* and Buy Now *(on page 17)* chapters.
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.

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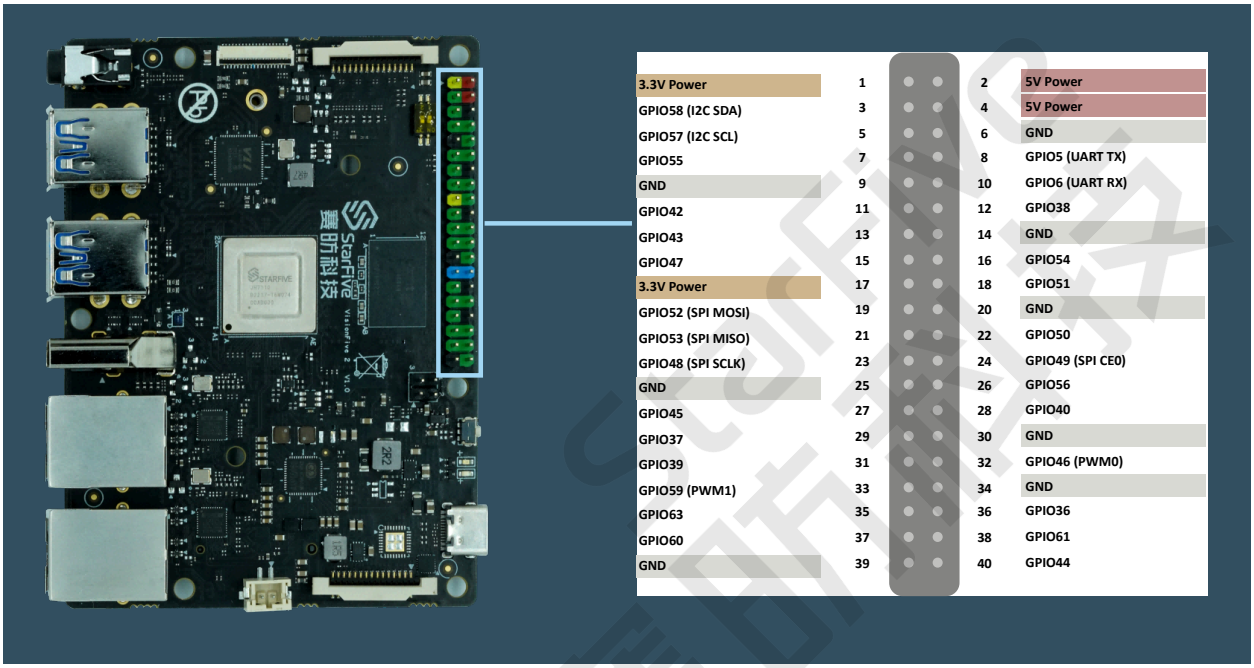
1. Introduction

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 GPIO Header Definition

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

Figure 1-1 40-Pin GPIO Header Definition



Note:
The multiplexed pin has been initialized and cannot be used as a general GPIO.

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 6.6
- OS: Debian 13
- SBC: VisionFive 2
- SoC: JH-7110

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 Board	-
General	M	• 32 GB (or more) micro-SD card • Micro-SD card reader • Computer (Windows/Mac OS/Linux) • USB to serial converter (3.3 V I/O) • Ethernet cable • Power adapter (5 V / 3 A) • 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:

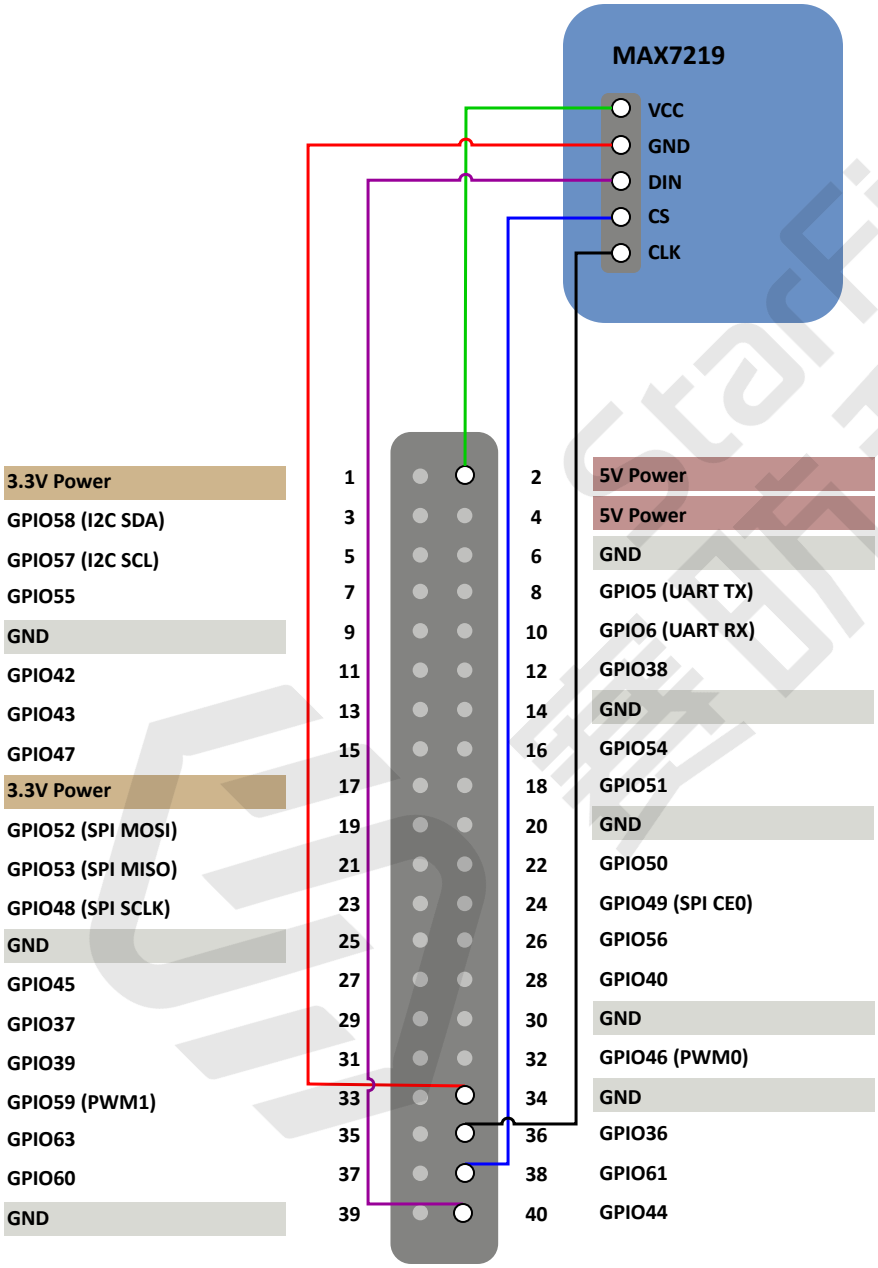
Table 2-2 Connect MAX7219 to the 40-Pin Header

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

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

MAX7219	40-Pin GPIO Header	
	Pin Number	Pin Name
DIN	40	GPIO44
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 JH-7110 EVB.

1. Flash Debian OS into a Micro-SD card as described in the *Flashing Fedora 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 and create a Python3 Virtual Environment on Debian:

```
sudo apt install python3-venv
python3 -m venv myvenv
```

Note:

You may rename “myvenv” according to your preference.

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

Note:
Due to the fact that `pypi.org` official website does not yet support uploading `whl` installation packages for the RISC-V platform, so it cannot directly execute `python3 -m pip install VisionFive.gpio` command to install online.

Please follow the steps below to install the `VisionFive.gpio` package.

a. Execute the following command to install dependent package within the newly created virtual environment:

```
sudo apt install libxml2-dev libxslt-dev
source ./myvenv/bin/activate
python3 -m pip install requests wget bs4
```

b. Execute the following command to run the installation script `Install_VisionFive_gpio.py`:

```
python3 Install_VisionFive_gpio.py
```

The installation script codes are as follows:

```
import requests
import wget
import sys
import os
from bs4 import BeautifulSoup

def parse_data(link_addr, class_type, key_str):
    req = requests.get(url=link_addr)
    req.encoding = "utf-8"
    html = req.text
    soup = BeautifulSoup(req.text, features="html.parser")
    package_version = soup.find(class_type, class_=key_str)
    dd = package_version.text.strip()
    data = dd.split()
    return data

def parse_link(link_addr, class_type, key_str):
    version_list = []
    req = requests.get(url=link_addr)
    req.encoding = "utf-8"
    html = req.text
    soup = BeautifulSoup(req.text, features="html.parser")
```

```
    search_data = soup.find_all(class_type, class_=key_str)
    for i in range(0, len(search_data)):
        search_data[i] = search_data[i].find("a").get("href)
        version_list.append(search_data[i].split("cp")[-1].split("-")[0])

    python_version = sys.version
    python_version = python_version.split(".")[0] + python_version.split(".")[1]

    for i in range(0, len(search_data)):
        if python_version == version_list[i]:
            return search_data[i]

    return search_data[0]

def get_dl_addr_page():
    link_address = "https://pypi.org/project/VisionFive.gpio/#history"
    key_str = "release version"
    class_key = "p"
    data_get = parse_data(link_address, class_key, key_str)
    latest_version = data_get[0]
    dl_addr_page
 = "https://pypi.org/project/VisionFive.gpio/{}/#files".format(latest_version)
    return dl_addr_page

def get_dl_addr_of_latest_version(link_addr):
    key_str = "card file card"
    class_key = "div"
    addr_get = parse_link(link_addr, class_key, key_str)

    return addr_get

def main():
    dl_addr_p = get_dl_addr_page()
    whl_dl_addr = get_dl_addr_of_latest_version(dl_addr_p)

    whl_name = whl_dl_addr.split("/")[-1]
    whl_name_suffix = os.path.splitext(whl_name)[-1]
    whl_name_prefix = os.path.splitext(whl_name)[0]
    whl_name_prefix_no_platform = whl_name_prefix[0: len(whl_name_prefix) - 3]
    new_platform = "linux_riscv64"

    rename_whl_name = "{}{}{}".format(whl_name_prefix_no_platform, new_platform,
 whl_name_suffix)

    wget.download(whl_dl_addr, out=rename_whl_name)

    os.system("pip install " + rename_whl_name)
    os.system("rm -rf " + rename_whl_name)

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

c. (Optional) Exit the Python3 Virtual Environment.

```
deactivate
```

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. Source into the Python3 Virtual Environment:

    ```
    source ./myvenv/bin/activate
    ```

    b. Execute the following command to install dependency:

    ```
    python3 -m pip install pillow
    ```

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

    ```
    python3 -m pip show VisionFive.gpio
    ```

    Result:

    ```
    Location: /home/user/myvenv/lib/python3.11/site-packages
    ```

    Note:

    The actual output depends on how the application is installed.

    d. Execute the following to enter the directory, for example, `/home/user/myvenv/lib/python3.11/site-packages` as indicated in the previous step output:

    ```
    cd /home/user/myvenv/lib/python3.11/site-packages
    ```

    e. 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
    ```

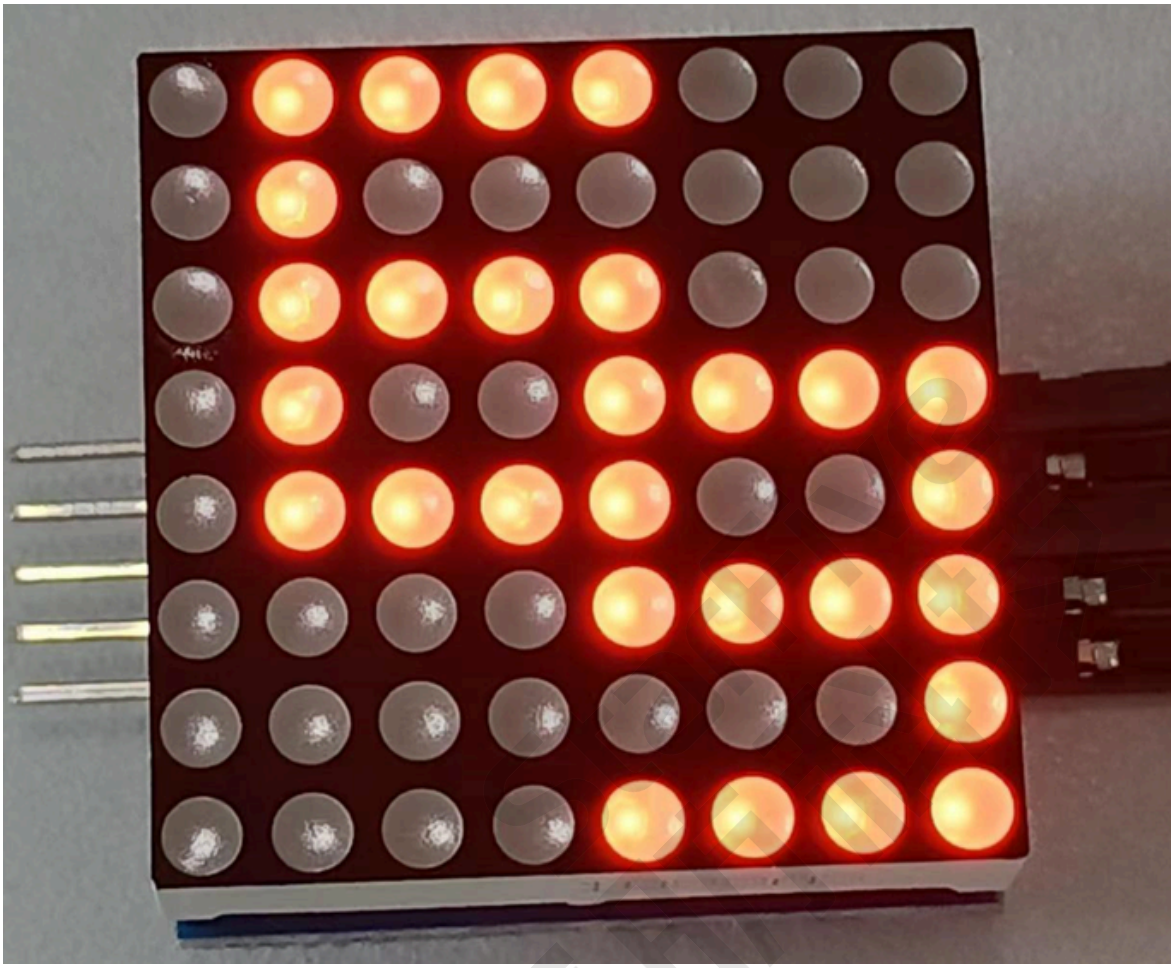
    Alternatively, you can execute the following command:

    ```
    sudo python3 LED_Matrix.py
    ```

    Result:

    The Led Matrix module displays with the StarFive logo.

Figure 3-1 Example Output



3. (Optional) Exit the Python3 Virtual Environment.

```
deactivate
```

4. Demo Source Code

The Python source code of this demo is provided for reference purposes 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())
```

5. Resources

Click on this tab to find all SBC relevant resources.

StarFive provides the following resources to guide you through an extraordinary experience on using the VisionFive 2 SBC.

- RVspace Wiki
- Application Center
- Documentation Center
- Technical Forum
- VisionFive 2 GitHub Repository
- VisionFive 2 Debian OS Download
- Code download
- View All PDF Documents

6. Buy Now

Click on this tab to find all the online shops and compatible accessories.

Buy SBC

Use the following page to find your nearest sales channel or the global channels for purchasing a VisionFive 2 Single Board Computer (SBC).

- Buy VisionFive 2

Buy Parts

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- Buy Accessory