# P42 Pico2 M.2

# Rev 3

Designed by Pier42 Electronics Design

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https://lectronz.com/stores/pier42design

https://www.tindie.com/stores/pier42/

https://hackaday.io/project/199091-rp2040-rp2350-m2-pico

https://github.com/wolfgangfriedrich/P42-Pico_Mdot2

# Table of Contents

# Introduction

A RPi Pico2 RP2350A microcontroller board in m.2 3024 size form factor with A and E key. The m.2 interface has USB, UART, I2C and control IO connectivity. Voltage levels for the m.2 specification are obeyed as some of the interfaces run on 1.8 V. Externally, +3.3 V, GND, the SWD interface and 16 IOs are accessible on castellated pins. A footprint for a QWIIC connector is on the top side of the board, not populated to have the board as low profile as possible. Power rail LEDs and a user controlled LED is on board, as well as a solder bridge for configuration options. Bottom side has a micro-SD card slot for data storage.

A microcontroller could give any host computer flexible and excellent real-time IO and data processing capabilities. The RPi Pico with its programmable PIO interface has excellent timing resolution.

Full Feature List:

- M.2 2230-D5-AE card (22 mm x 30 mm; D5 = 1.5mm on top and bottom side violated by the QWIIC connector and the bottom SD card holder; A and E key)
- Used interfaces on the M.2: USB, UART, I2C, ALERT, WAKE, DISABLE1/2, LED 1/2, VENDOR_DEFINED
- 1.8V regulator for level-shifters
- Power LEDs for 3.3 V and 1.1 V
- RP2040/RP2350 peripherals: 2 MB Flash, SWD debug access, RESET and BOOTSEL button,
- QWIIC connector, 1 LED, 1 solder bridge for configuration, 16 GPIOs on castellated pins
- castellated pins on 25.4 mm/0.1" raster (almost with a 22 mm board)
- optional µSD card holder on the bottom side
- optional pull-down resistors on castellated IOs to mitigate the E9 Erratum

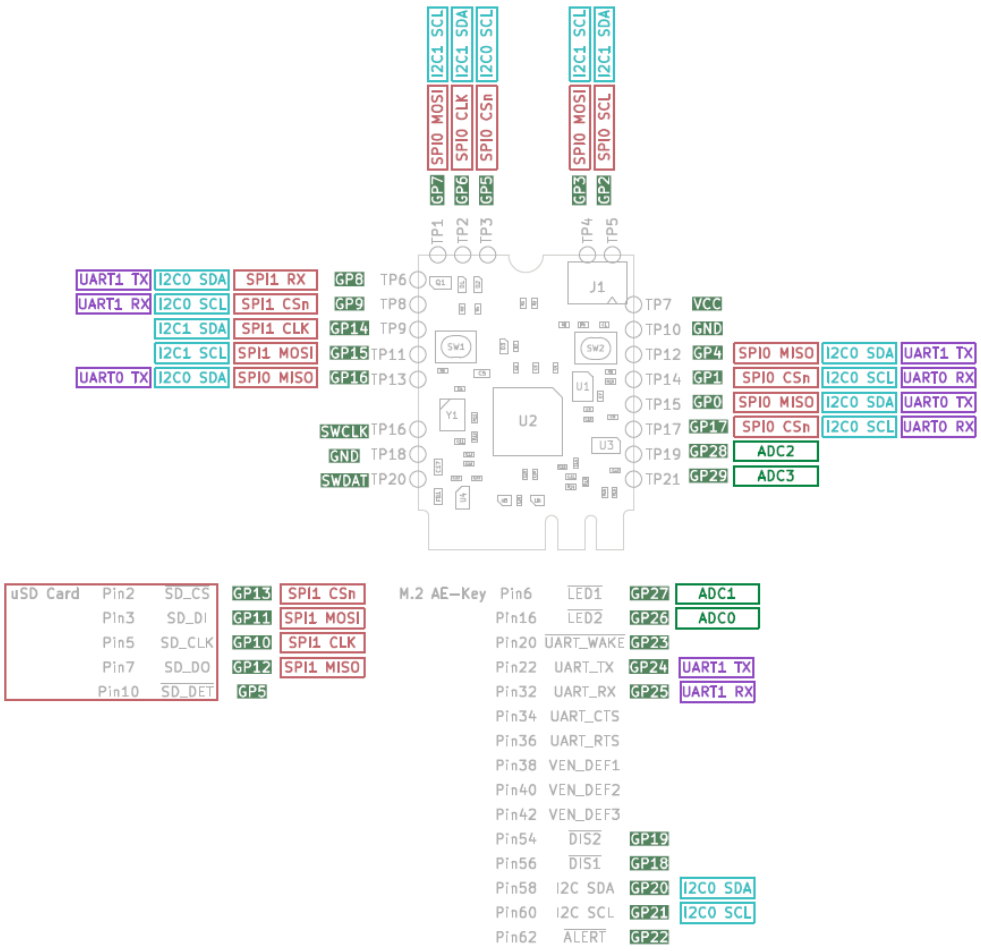
Main Components

- Microcontroller RaspberryPi RP2350A
- 16Mbit QSPI Flash W25Q16
- 12 MHz Crystal SMD_3225-4Pin_3.2x2.5mm
- MicroSD card holder Molex 104031-0811
- 1.8V-3.3V High Speed level shifter Texas Instruments TXS0102

# Hardware

The board is a standard M.2 2230-D5-AE card (22 mm x 30 mm; 0.8mm thickness; D5 = 1.5mm on top and bottom side violated by the QWIIC connector and the bottom SD card holder; A and E key). The M.2 card edge connector is ENIG plated. Castellated pins are on a 2.54mm (0.1”) raster per side. The mechanical constriants did not work out to have all pins on a global 2.54mm (0.1”) raster.

## Pico2 M.2 Pinout




## M.2 Port Interface

I2C interface on pins 60 (SCL) and 58 (SDA) has address 0x42.

Only the connected pins of this board are listed in this interface table. This is not a full port specification

| Pin Nr | Name | IO | Description | Voltage |
|---|---|---|---|---|
| 1 | GND | Power | Return current path | 0 V |
| 2 | 3.3V | Power | 3.3 V source | 3.3 V |
| 3 | USB+ | IO | USB Data ± Differential serial data interface compliant to the USB 2.0 Specification | |
| 4 | 3.3V | Power | 3.3 V source | 3.3 V |
| 5 | USB- | IO | USB Data ± Differential serial data interface compliant to the USB 2.0 Specification | |
| 6 | nLED1 | OUT | Open drain, active low signal. These signals are used to allow the add-in card to provide status indicators via LED devices that will be provided by the system. These LED devices should be tied to +3.3V through a current limiting resistor. Current should be limited to 9mA when LED is On. | 3.3 V |

| | | | | |
|---|---|---|---|---|
| 7 | GND | Power | Return current path | 0 V |
| 8 | A Key | - | | |
| 9 | A Key | - | | |
| 10 | A Key | - | | |
| 11 | A Key | - | | |
| 12 | A Key | - | | |
| 13 | A Key | - | | |
| 14 | A Key | - | | |
| 15 | A Key | - | | |
| 16 | nLED2 | OUT | Open drain, active low signal. These signals are used to allow the add-in card to provide status indicators via LED devices that will be provided by the system. These LED devices should be tied to +3.3V through a current limiting resistor. Current should be limited to 9mA when LED is On. | |
| 17 | n.c. | | | |
| 18 | GND | Power | Return current path | 0 V |
| 19 | n.c. | | | |
| 20 | nWAKE | OUT | Sideband Wake. Open Drain, Active Low. Require pull up on the host side (recommended 15K to 100K ) | 3.3 V |
| 21 | n.c. | | | |
| 22 | TxD | OUT | UART Transmit Data connected to RXD on the platform. | 1.8 V |
| 23 | n.c. | | | |
| 24 | E Key | - | | |
| 25 | E Key | - | | |
| 26 | E Key | - | | |
| 27 | E Key | - | | |
| 28 | E Key | - | | |
| 29 | E Key | - | | |
| 30 | E Key | - | | |
| 31 | E Key | - | | |
| 32 | RxD | IN | UART Receive Data connected to TXD on the platform. | 1.8 V |
| 33 | GND | Power | Return current path | 0 V |
| 34 | CTS | OUT | Can be connected to RTS through a 0402 resistor footprint. No connection on the module. | |
| 35 | n.c. | | | |
| 36 | RTS | IN | Can be connected to CTS through a 0402 resistor footprint. No connection on the module. | |
| 37 | n.c. | | | |
| 38 | VEN DEF1 | OUT | May be pulled up to +3.3V through a resistor on the board. | |
| 39 | GND | Power | Return current path | 0 V |
| 40 | VEN DEF2 | OUT | May be pulled down to GND through a resistor on the board. | |
| 41 | n.c. | | | |

| | | | | |
|---|---|---|---|---|
| 42 | VEN DEF3 | OUT | May be pulled down to GND through a resistor on the board. | |
| 43 | n.c. | | | |
| 44 | n.c. | | | |
| 45 | GND | Power | Return current path | 0 V |
| 46 | n.c. | | | |
| 47 | n.c. | | | |
| 48 | n.c. | | | |
| 49 | n.c. | | | |
| 50 | n.c. | | | |
| 51 | GND | Power | | |
| 52 | n.c. | | | |
| 53 | n.c. | | | |
| 54 | nDISABLE2 | IN | Active low, debounced signal when applied by the system it will disable radio operation on the add-in cards that implement radio frequency applications. When implemented, these signals require a pull-up resistor on the card. | 3.3 V |
| 55 | n.c. | | | |
| 56 | nDISABLE1 | IN | Active low, debounced signal when applied by the system it will disable radio operation on the add-in cards that implement radio frequency applications. When implemented, these signals require a pull-up resistor on the card. | 3.3 V |
| 57 | GND | Power | Return current path | 0 V |
| 58 | SDA | IO | I2C data | 3.3 V |
| 59 | n.c. | | | |
| 60 | SCL | IN | I2C clock input from host | 3.3 V |
| 61 | n.c. | | | |
| 62 | nALERT | OUT | IRQ line to host processor; Active Low | 3.3 V |
| 63 | GND | Power | Return current path | 0 V |
| 64 | n.c. | | | |
| 65 | n.c. | | | |
| 66 | n.c. | | | |
| 67 | n.c. | | | |
| 68 | n.c. | | | |
| 69 | GND | Power | Return current path | 0 V |
| 70 | n.c. | | | |
| 71 | n.c. | | | |
| 72 | +3.3V | Power | 3.3 V source | 3.3 V |
| 73 | n.c. | | | |
| 74 | +3.3V | Power | 3.3 V source | 3.3 V |
| 75 | GND | Power | Return current path | 0 V |

**Table 1: M.2 Port Interface Pins**

1) All IO directions are from the module point of view.

## Castellated GPIO Pin Interface

| Pin Nr | Name | IO | RP2350A GP port | Description |
|---|---|---|---|---|
| 1 | TP1 | | GP7 | LED |
| 2 | TP2 | | GP6 | EN |
| 3 | TP3 | | GP5 | nSD_DET |
| 4 | TP4 | | GP3 | QWIIC SCL |
| 5 | TP5 | | GP2 | QWIIC SDA |
| 6 | TP6 | | GP8 | |
| 7 | TP7 | | - | +3.3 V |
| 8 | TP8 | | GP9 | |
| 9 | TP9 | | GP14 | |
| 10 | TP10 | | - | GND |
| 11 | TP11 | | GP15 | |
| 12 | TP12 | | GP4 | |
| 13 | TP13 | | GP16 | |
| 14 | TP14 | | GP1 | |
| 15 | TP15 | | GP0 | |
| 16 | TP16 | | SWCLK | |
| 17 | TP17 | | GP17 | |
| 18 | TP18 | | - | GND |
| 19 | TP19 | | GP28 | ADC2 |
| 20 | TP20 | | SWD | |
| 21 | TP21 | | GP29 | ADC3 |

## Control/Status Interface

| Pin Nr | Name | IO | Description |
|---|---|---|---|
| | EN | IN | |
| | LED | OUT | |
| | SD_DET | IN | |
| | | | |
| | SWCLK | | |
| | GND | | |
| | SWD | | |

## QWIIC Connector

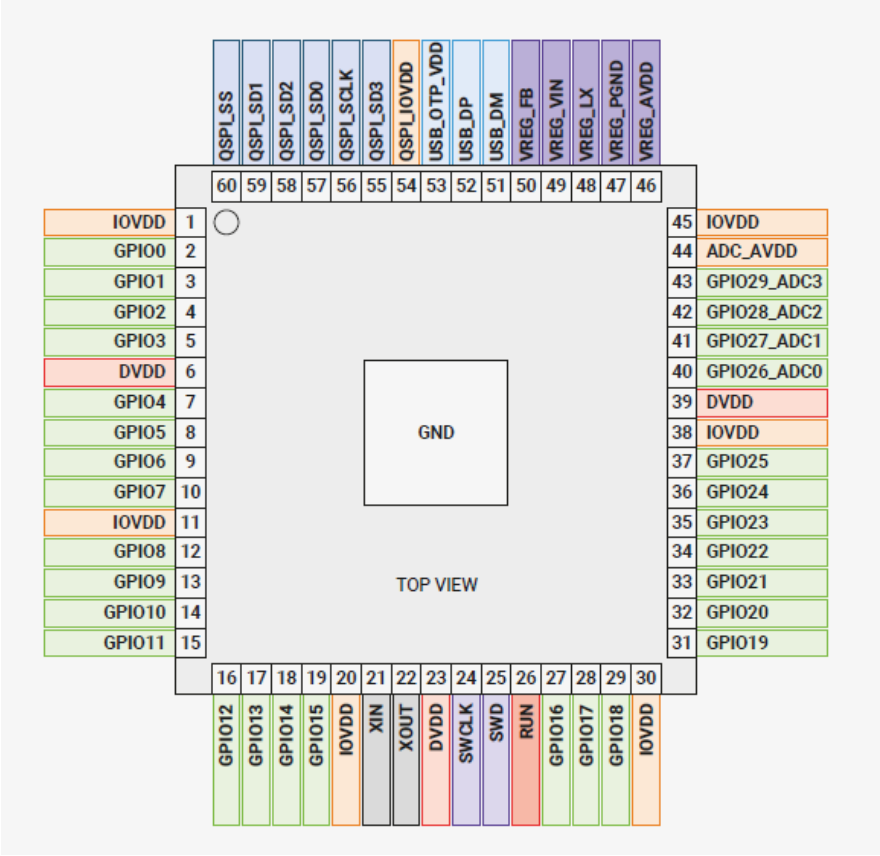
A right angle QWIIC connector (part number JST SH-SM04B_SRSS_TB 1x4 1mm pitch).

| Pin Nr | Name | IO | Description |
|---|---|---|---|
| 1 | GND | Power | Reference return, because ground is where the potatoes grow. |
| 2 | Vcc | Power | +3.3 V |
| 3 | SDA | IO | I2C data signal with 47 KΩ pull-up. |
| 4 | SCL | IO | I2C clock signal with 47 KΩ pull-up. |

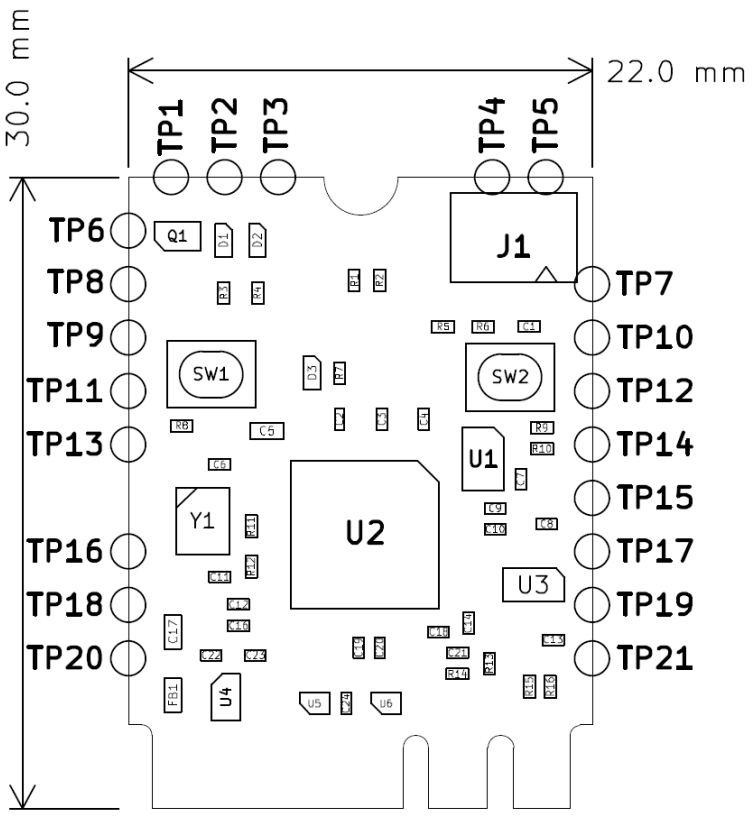
## µSD Card Connector

A Molex 104031-0811 µSD Card adapter, connected though standard SPI (not SDIO), which limits the data transfer rate to ~180 Kbyte/sec.

## RP Pico2 pin-port map

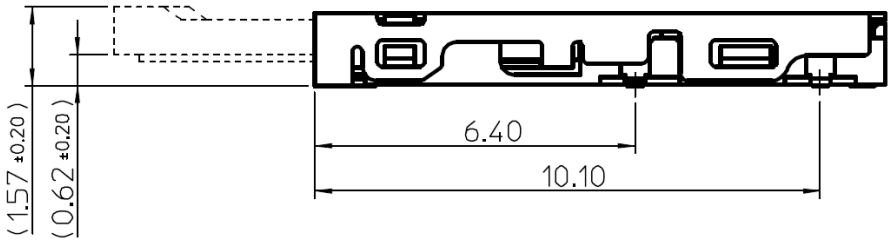



## Mechanical Dimensions




The SD card holder on the bottom side has a thickness of 1.57mm with inserted SD card. Some M.2 configurations have less clearance on the bottom side. The SD card holder without an inserted card is 1.42mm high.

Also, if the SD card is used together with TP9, TP11, TP13 or TP16; make sure that no solder or wire is protruding on the bottom side, to not interfere with the SD card insertion area.




# Software

A test software is available, it implements a simple command line on the integrated USB-UART port.

The source code is written in Arduino and available on the project GitHub.

## Command Description

Command v – Version

Command ? – Help

Command l – LED

Command u – UART

Command I – I2C

Command g – GPIO

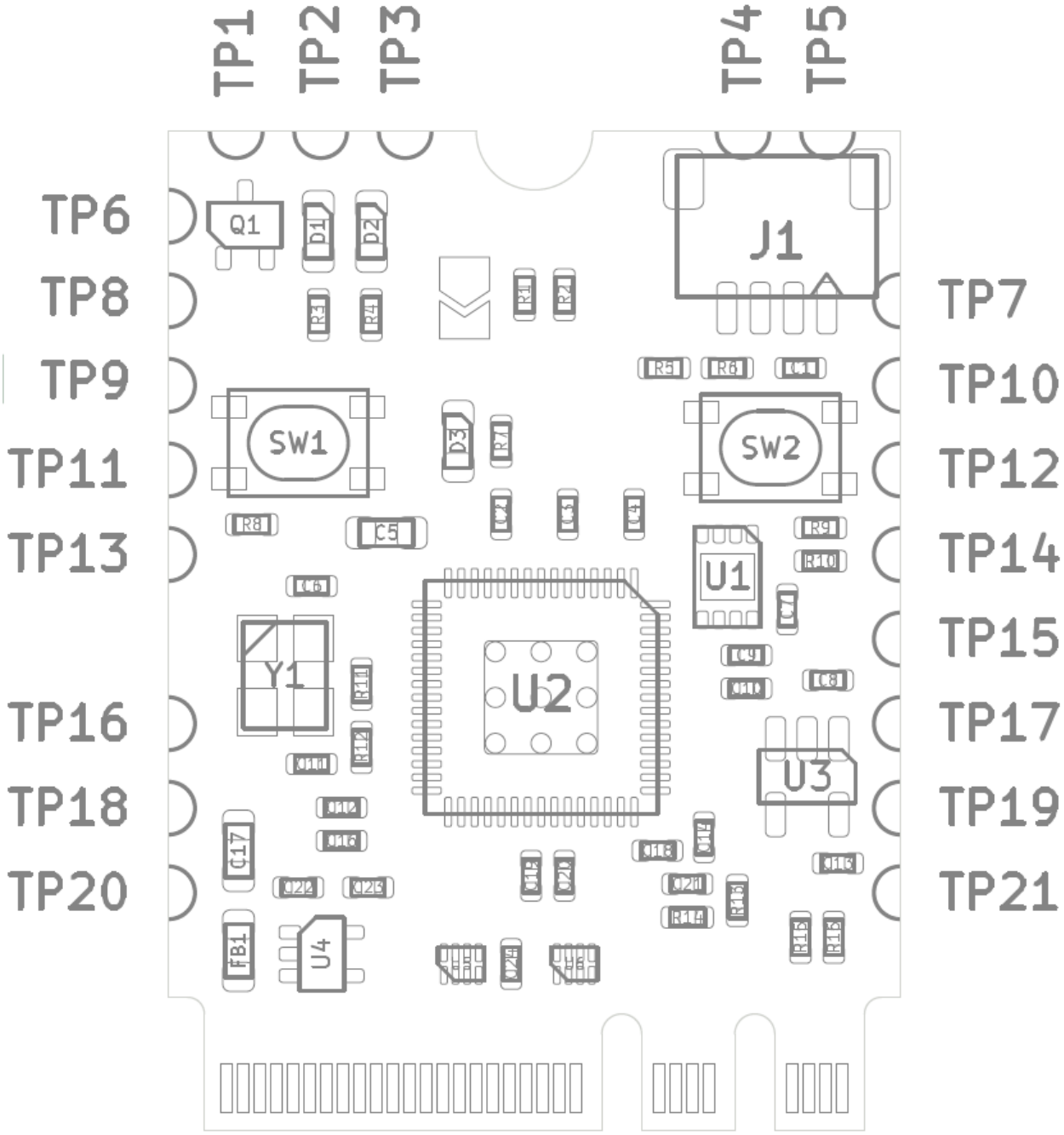
Command s – SDcard test

Command d – SDcard directory

Command m – IO pin map

Command t – Test function

# Assembly Drawing


TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
TP11
TP12
TP13
TP14
TP15
TP16
TP17
TP18
TP19
TP20
TP21
Q1
D1
D2
J1
R3
R4
R1
R2
R5
R6
C1
SW1
SW2
D3
R7
C2
C3
C4
R8
C5
R9
R10
U1
C6
C7
Y1
U2
C9
C10
C8
R11
R12
C11
U3
C12
C13
C17
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C16
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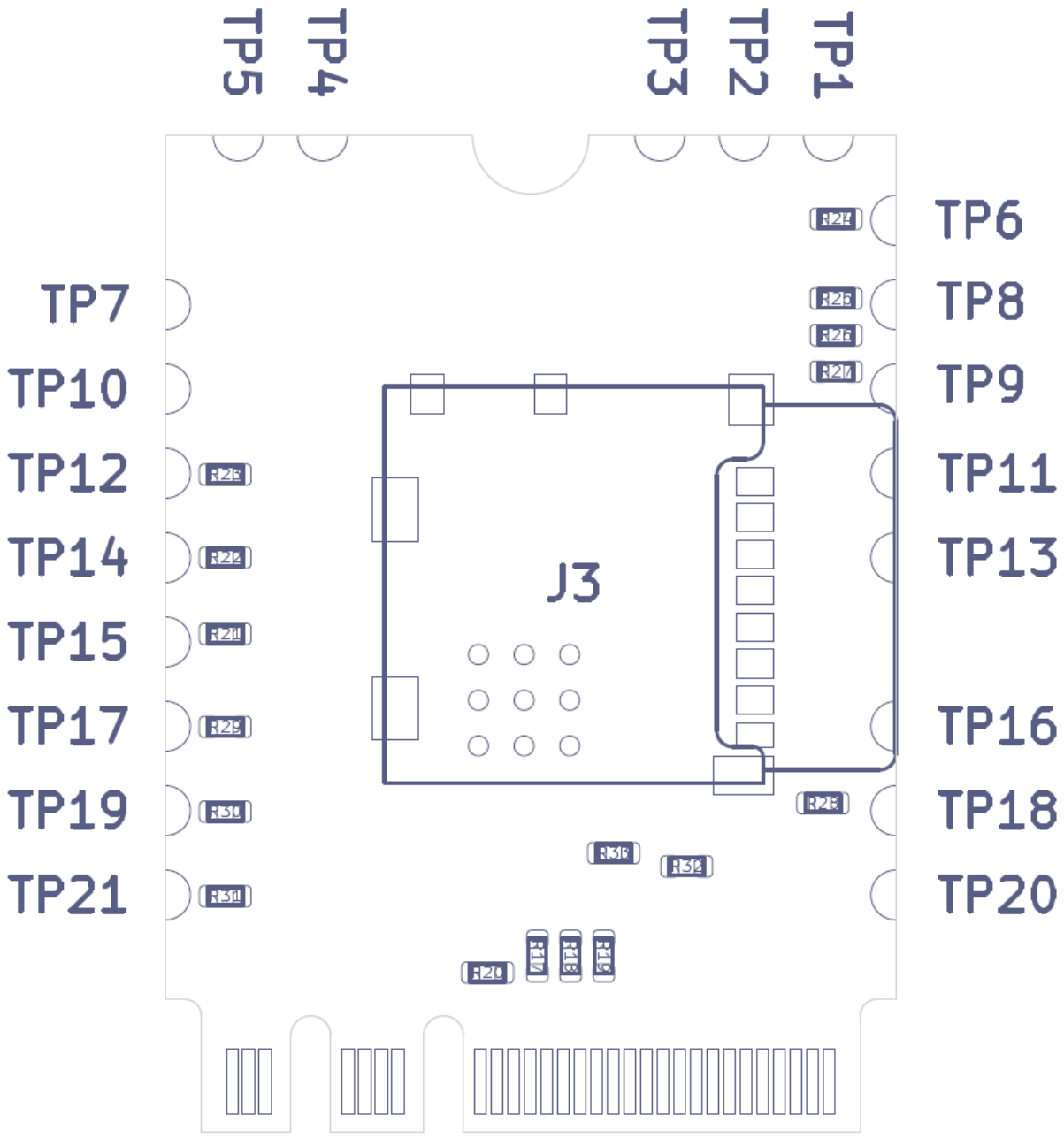
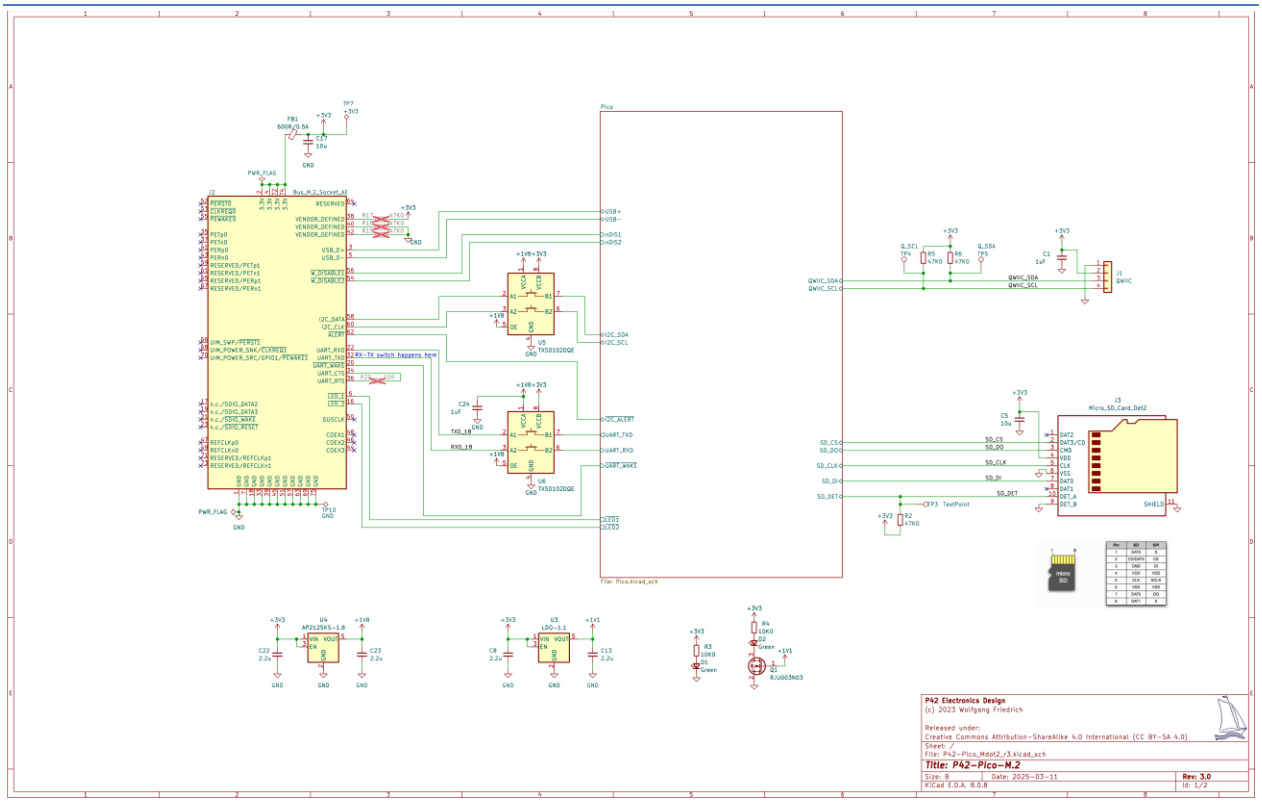
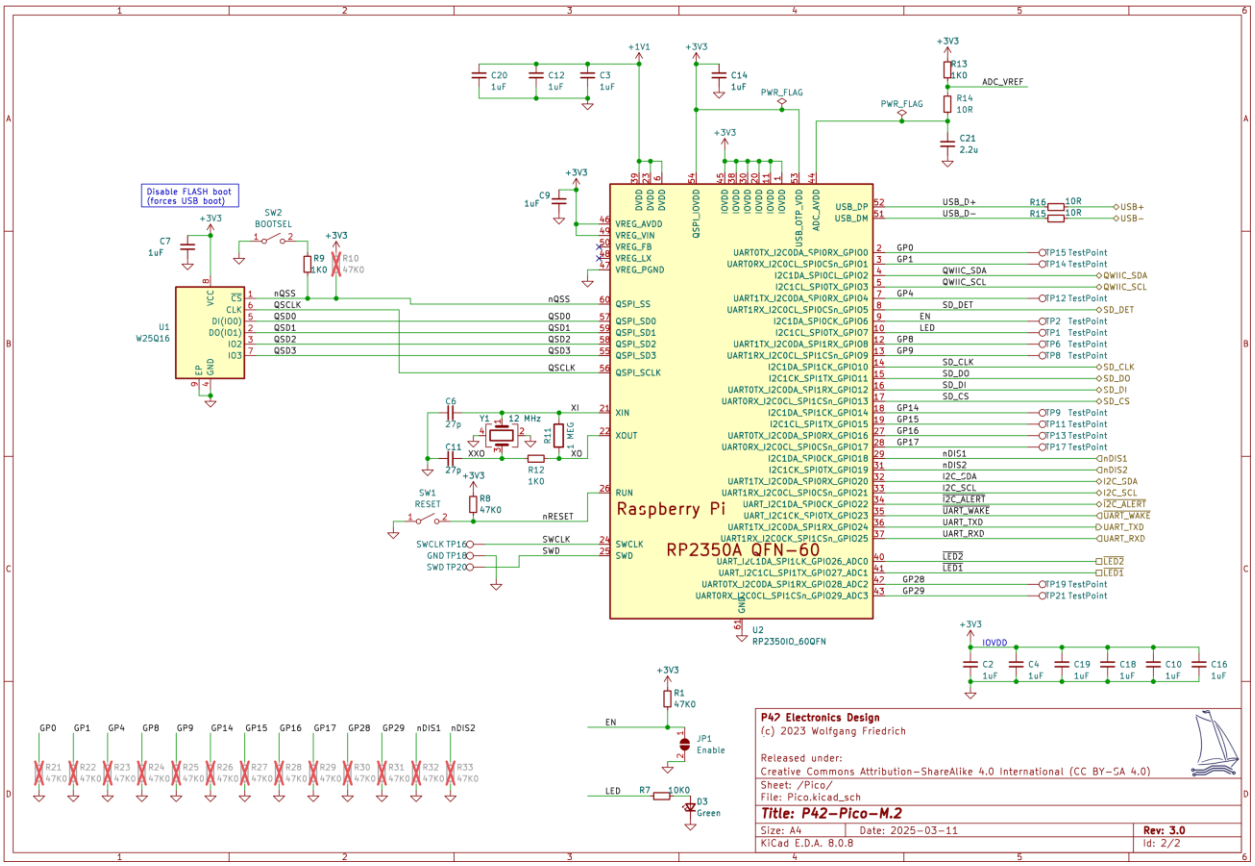
Q23
R13
R14
R15
R16
FB1
U4
Q24
Q21
Q20


TP5
TP4
TP3
TP2
TP1
TP6
TP7
TP8
TP10
TP9
TP12
TP11
TP14
TP13
TP15
TP17
TP16
TP19
TP18
TP21
TP20
J3

# Schematics




Disable FLASH boot
(forces USB boot)
Raspberry Pi
RP2350A QFN-60
W25Q16
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Sheet: /Pico/
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Title: P42-Pico-M.2
Size: A4
Date: 2025-03-11
KiCad E.D.A. 8.0.8
Rev: 3.0
Id: 2/2

# M.2 Pin Reference

This is a living document. Any missing content will be added as required.

# Revision Control

| Version | Data | Changes |
|---|---|---|
| 1.0 | 22. Mar 2025 | Initial Release Rev 3 Madman Chicken-Scratch Manifesto |