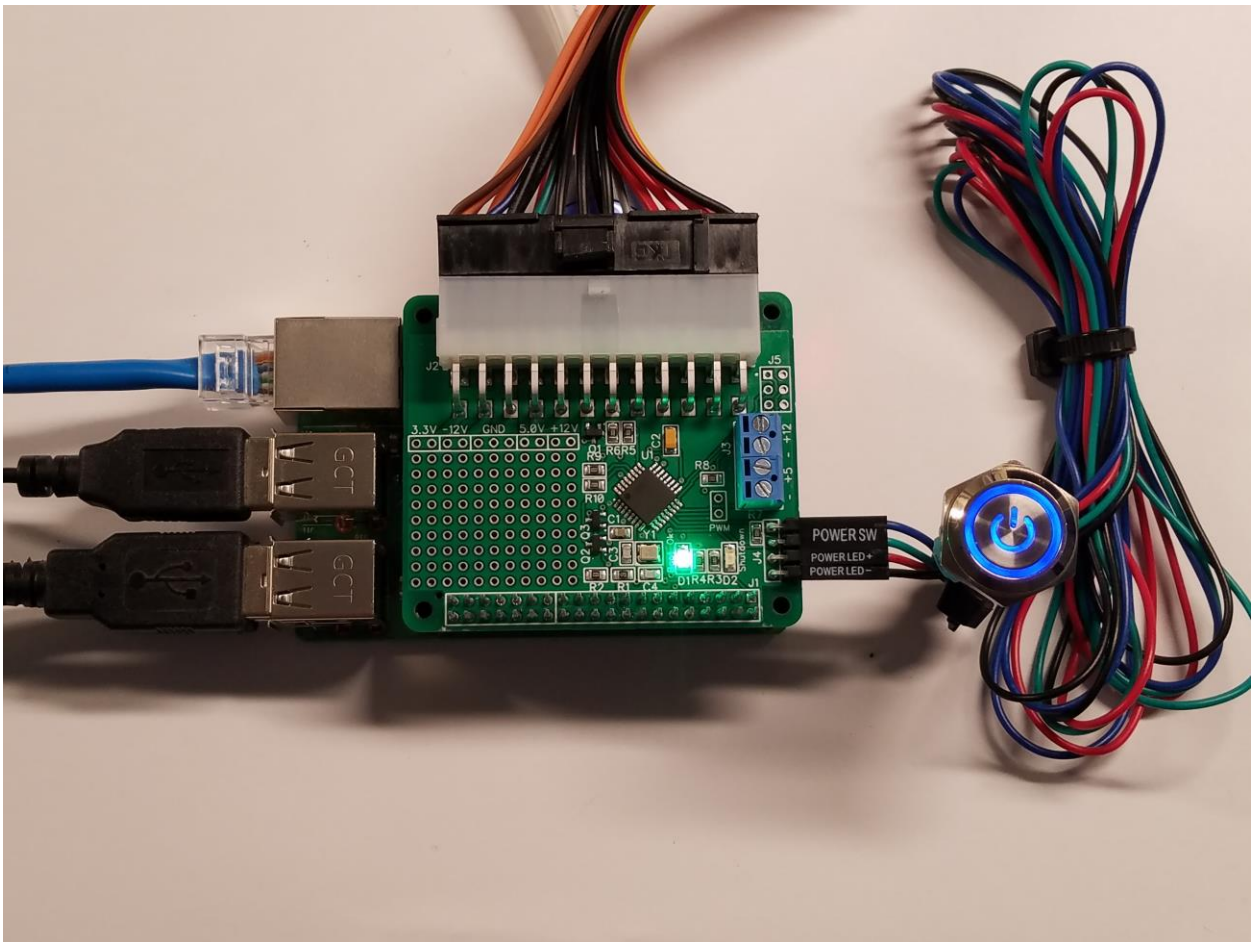
pod bay 3



Mini ATX PSU II for Raspberry Pi

Revision 1.0 User Manual

Mini ATX PSU II for Raspberry Pi
Installation and User Guide.

February 8 2021

Overview

Congratulations on your purchase of the Mini ATX PSU II for Raspberry Pi (Mini ATX PSU)!

Please read this entire manual before using to ensure you receive maximum benefit from this board while protecting your investment in your Raspberry Pi.

While reading this document, please refer to the graphic below on the following pages.

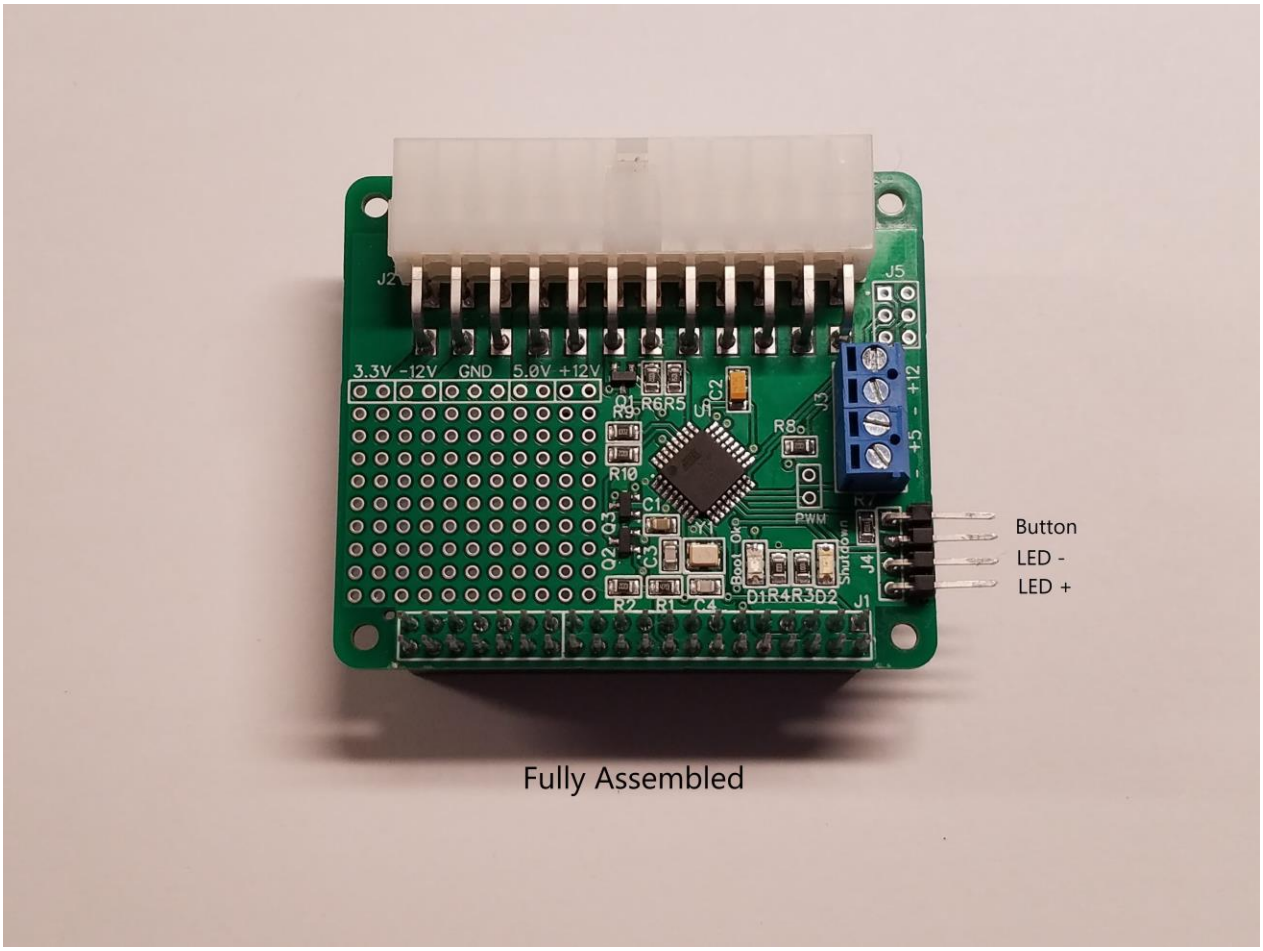


Figure 1 - Mini ATX PSU for Raspberry Pi

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Features

- Features soft shutdown and reboot of the Raspberry Pi to minimize disk file corruption
- Includes configurable watchdog timer to power cycle the Raspberry Pi in case of operating system freeze
- Includes configurable power management to automatically restart the Raspberry Pi after a power failure
- Works with most inexpensive off the shelf ATX desktop supplies using 20 or 24 pin ATX connectors
- Screw terminals break out +12 VDC and +5 VDC for user projects. The screw terminals are rated for 3.0 amps
- PCB is 1oz copper with lead free HASL finish
- Conforms to the Raspberry Pi Foundation's HAT footprint

Installing the Mini ATX PSU for Raspberry Pi

The purpose of the Mini ATX PSU is to back power your Raspberry Pi from an ATX style desktop power. **Therefore, you must not plug the Raspberry Pi into any other power supply while the Mini ATX PSU is installed otherwise damage to your Raspberry Pi WILL occur.**

You will install the Mini ATX PSU in this order:

1. Unbox the Raspberry Pi. Assemble those components and install the latest operating system per the given instructions.
2. Use a recommended power supply to verify that the OS boots up properly.
3. Download and install recommended operating system updates.
4. Enable I2C through the operating system Configuration Panel.
5. Shutdown the operating system from the main menu.
6. Disconnect power supply.
7. Mount the Mini ATX PSU to the GPIO header on the Raspberry Pi with the supplied mounting kit:
    a. If you're using the extra tall stacking header, note that there are four extra nuts. These are used as spacers and are screwed onto the male ends of the standoffs to give the standoffs their proper height.
    b. Connect the Mini ATX PSU to the ATX power supply, power LED and power button.
    c. Turn on the ATX power supply. You should notice that the power and Boot Ok LEDs flash in quick succession. This indicates that the Mini ATX PSU is now ready to use.
8. Turn on power to the Raspberry Pi by depressing the power button. Allow the Raspberry Pi to boot up. The Mini ATX PSU will now be waiting for the Boot Ok command from the Raspberry Pi.

9. Run “sudo i2cdetect –y 1” in the command window to verify that the Mini ATX PSU is found at the default address of 0x5A on the I2C bus.
10. Install the required boot script on to the Raspberry Pi. When you install the boot script, the service that listens for the Mini ATX PSU will start up and send a Boot Ok command to the Mini ATX PSU.
11. Reboot by typing ‘sudo reboot’ in the command window. Alternatively, depress the power button for a half a second then release. When the Raspberry Pi reboots, the Boot Ok LED will now illuminate and the Mini ATX PSU will be waiting for a power down request.

Installing the Mini ATX PSU Boot Script

You will find the necessary boot install script at: https://github.com/tomtibbetts/ATX-Watchdog-for-Pi/blob/main/scripts/ATX-Watchdog_install.sh. This script assumes that you are running a version of Linux that is compatible to Raspbian. This script installs two services on the Raspberry Pi.

The first service does the following:

1. Sends a Boot Ok command to the Mini ATX PSU.
2. Waits for a shutdown signal from the Mini ATX PSU.
3. Initiates either a reboot or a shutdown command on the Raspberry Pi depending on the length of the shutdown pulse received from the Mini ATX PSU.

Please note that the first service requires the use of GPIO 5 (pin 18, ‘Shutdown’). This pin was selected because it does not conflict with special use pins such as I2C, SPI or UART pins.

The second service executes when the Raspberry Pi starts to reboot or shutdown. When this happens, this service sends a command to the Mini ATX PSU to turn off the Boot Ok LED. It then waits until the Raspberry Pi either reboots or shuts down. If the Raspberry Pi shuts down, the Mini ATX PSU will shut power off to the Raspberry Pi after a configurable delay to give the Raspberry Pi enough time to properly unmount file systems and resources.

To install the script, follow these instructions: (recommended to have Mini ATX PSU mounted on the GPIO header. Otherwise the Raspberry Pi may automatically shut down after reboot)

1. Open a command window and enter the following commands:
2. sudo wget https://raw.githubusercontent.com/tomtibbetts/ATX-Watchdog-for-Pi/main/scripts/ATX-Watchdog_install.sh. Alternatively, navigate to: https://github.com/tomtibbetts/ATX-Watchdog-for-Pi/blob/main/scripts/ATX-Watchdog_install.sh. Click on the “Raw” button. It is found above the script text, on the header

to the right. Copy and paste the URL into the command window after "sudo wget " then hit enter.

3. sudo bash ATX-Watchdog_install.sh – This will start both services. The Boot Ok LED should now light indicating a successful install.
4. sudo rm ATX-Watchdog_install.sh to remove the install script.
5. sudo reboot.

Operating Modes

Turning on the ATX Power Supply:

Turning on/plugging in the ATX power supply will supply a trickle voltage to the microcontroller on the Mini ATX PSU. The Mini ATX PSU will flash the power and Boot Ok LEDs in rapid succession to indicate the board is powered up and functioning.

Power up the Raspberry Pi:

Depressing the power switch when the Raspberry Pi is turned off will initiate the power up sequence. The power indicator LED pulsates slowly until the Boot Ok command is received from the Raspberry Pi. When the Boot Ok command is received, the Boot Ok LED lights and the power LED goes steady on.

Reboot:

Depressing the power switch for greater than a half a second and less than three seconds while the Raspberry Pi is on will initiate a reboot of the Raspberry Pi. The power LED dims and the shutdown LED pulses once to signal the Raspberry Pi to reboot. When the Raspberry Pi starts to reboot, it sends a command to the Mini ATX PSU to turn off the Boot Ok LED. The power LED will then pulsate until the Raspberry Pi has rebooted and the Mini ATX PSU receives the Boot OK command. The power and Boot Ok LEDs will then go steady on.

Shutdown:

Depressing the power switch for over three seconds while the Raspberry Pi is on will initiate a shutdown of the Raspberry Pi. The power LED dims and the shutdown LED goes steady on to signal the Raspberry Pi to shut down. When the Raspberry Pi shuts down, it sends a command to the Mini ATX PSU to turn off the Boot Ok LED. The Mini ATX PSU will then wait a long enough period of time for the Raspberry Pi to perform a clean shutdown before turning off power to the Raspberry Pi.

Hard Shutdown:

In the event that the Raspberry Pi has frozen and is not responsive to commands from the Mini ATX PSU or user interaction, you may force the Mini ATX PSU to power off the Raspberry Pi. Depressing the power switch for greater than ten seconds will power off the Raspberry Pi.

Command line or Application Forced Shutdown:

The Mini ATX PSU has the ability to detect when a shutdown or reboot is initiated from the Raspberry Pi. When the user selects “Shutdown” or “Reboot” from the “Logout” menu, for example, the Raspberry Pi sends a command to the Mini ATX PSU to turn off the Boot Ok LED and to wait a configurable amount of time. While it’s waiting, the power LED will pulsate. If the Raspberry Pi successfully reboots, it will command the Mini ATX PSU to turn on the Boot Ok LED. If the Raspberry Pi does not reboot, for example the user initiated a shutdown, then the Mini ATX PSU powers off the Raspberry Pi.

Power Management (Optional)

The power management option directs how the Mini ATX PSU responds to power failure. In the event the power fails, the default mode of the Mini ATX PSU is keep the Raspberry Pi powered off. Optionally, you can configure the Mini ATX PSU to power on the Raspberry Pi after a power failure. Please refer to the section, “Programming the Mini ATX PSU” for more detailed instructions.

Watchdog Timer (Optional)

The Mini ATX PSU has the option of power cycling the Raspberry Pi in the event the Raspberry Pi freezes for some reason and can no longer communicate with the Mini ATX PSU. Please refer to the section, “Enabling the Watchdog Timer” for more detailed instructions on how to configure the watchdog timer.

Reset Default Values

You may, at any time, reset all edited parameters to their original values. There are two ways to do this:

1. Execute the Reset Default Values command (0x80) on the Mini ATX PSU. See the section, “Programming the Mini ATX PSU”.
2. Perform a hard reset upon powering up the ATX power supply.

To perform a hard reset, you first need to power off the ATX power supply and allow its capacitors to fully drain. This may take a few minutes.

Before powering up the ATX power supply, depress and hold down the power button. Turn on the power supply. The Boot Ok LED should give one long pulse. This indicates that you can now reset the Mini ATX PSU to its original values.

Release the power button.

If you do nothing, the Boot Ok LED will flash quickly after ten seconds. You can now use the Mini ATX PSU as before without having changed any values.

If you depress the power button, the Boot Ok LED will flash quickly in two sequences. The default values will have been restored and you can now proceed to use the Mini ATX PSU.

Assembling the Mini ATX PSU for Raspberry Pi

If you opted to purchase the kit, then you will need to do some assembly. Fortunately, there are only a handful of components to assemble. Additionally, we assume that you already have some experience assembling kits and soldering parts. If not, we strongly encourage you to practice soldering skills on high quality perf boards first. There are several Youtube videos on how to solder.

Regardless of your soldering skills, here are some things to consider:

1. Please use a soldering iron of sufficient wattage. A 40 watt pencil tip soldering iron will work. A hot iron will minimize cold solder joints and solder bridging between pins.
2. It helps to clean the pads where you will be soldering with rubbing alcohol. This will help produce better solder joints.
3. Double and triple check your solder joints so that you are not creating solder bridges between pins, especially on the power connectors. Also, ensure that solder joints have a 'filet'. See below:

4. When you have completed soldering, it is worth the effort to clean the board again to removed solder and flux residual. This will ensure a long life for your board. If don't already have some sort of flux remover, then try using rubbing alcohol and an old tooth brush.

The following order of assembly is recommended:

1. Test fit the header, J1 on the 40 pin GPIO header before soldering to ensure proper fit. Don't solder just yet.
2. Solder J4 – the header for the power button and LED.
3. Solder J1. Make sure that it is "upside down" i.e. with the female portion of the socket under the board so that it can mate with the GPIO header. For best results, make sure the socket is snug against the board and perpendicular to the board.
4. Solder the remaining parts in the following order: J3, and J2.

Do it Yourself Kit:

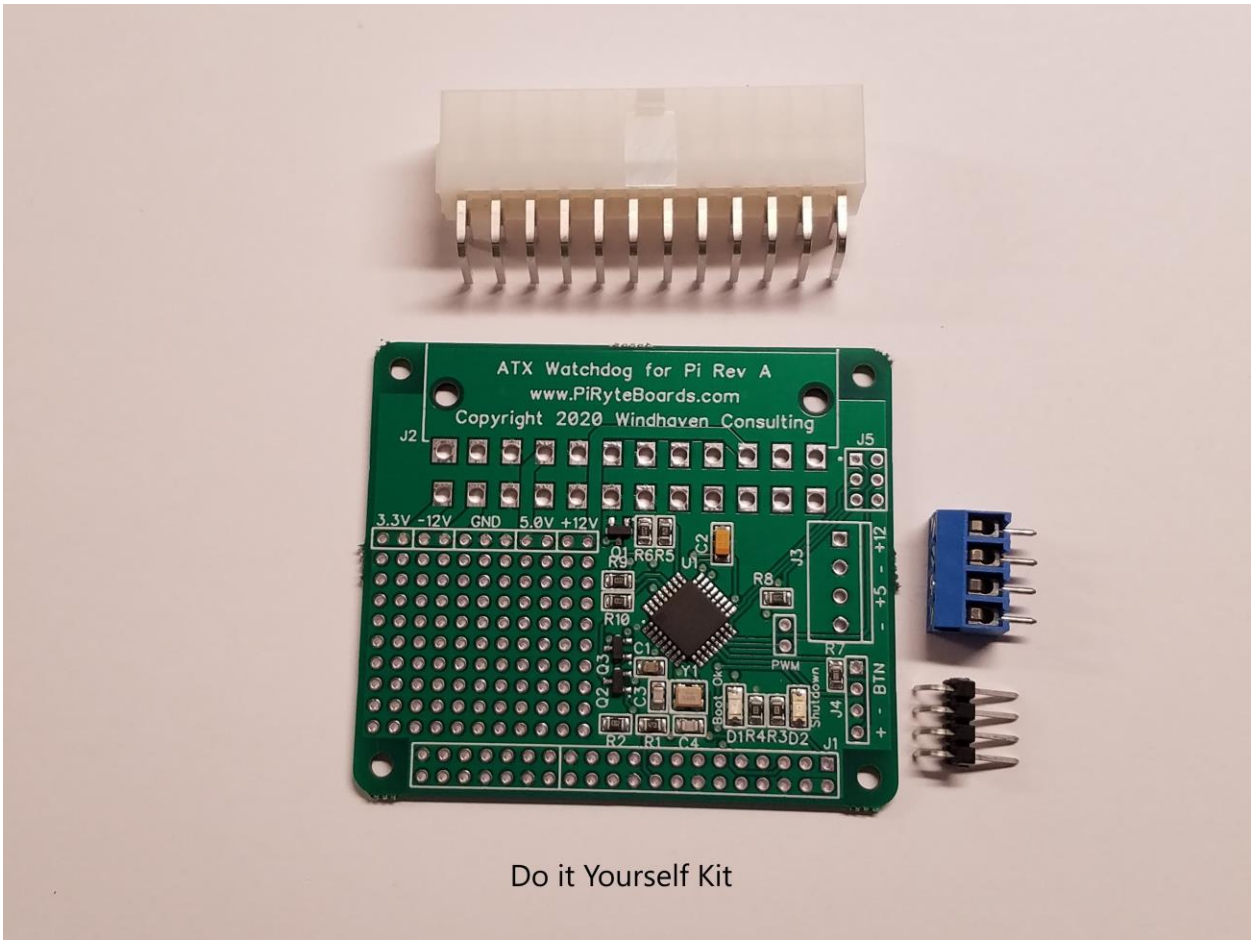


Figure 2: Parts Included in Kit

Registers and Commands:

The Mini ATX PSU comes out of the box with the watchdog and power management disabled. The various shut down and reboot delays are preset to handle most situations.

However, in the event you wish to change or read any of the preset values, you can do so by accessing the registers on the Mini ATX PSU over I2C. Additionally, you can send commands to the Mini ATX PSU to perform some operations. This is how the shutdown and watchdog services communicate with the Mini ATX PSU. Example code is located at: https://github.com/tomtibbetts/ATX-Watchdog-for-Pi/tree/main/scripts/examples.

Descriptions of the registers and commands are below:

Immutable Machine Values (read only)

Register	Address	Value	Notes
Revision Number High	0x21	0x01	Firmware Revision 1.0
Revision Number Low	0x22	0x00	Firmware Revision 1.0

Programmable Default Values (read/write)

Register	Address	Default Value	Notes
Shutdown Delay	0x31	10	0 – 255 Seconds
Remote Shutdown Delay	0x32	30	0 – 255 Seconds
Remote Shutdown Detect Delay	0x33	0	0 – 255 Seconds
Power Management	0x34	0x00	See description Below
Watchdog Timer	0x35	0x00	See description Below
Watchdog Timer Delay	0x36	120	0 – 255 Seconds. Watchdog is disabled if set to 0
Watchdog Timer Reboot Delay	0x37	120	0 – 255 Seconds
Watchdog Timer Power Cycle Delay	0x38	10	0 – 255 Seconds, 0 is not recommended
I2C Address	0x39	0x5A	

Registers 0x21 and 0x22 – Firmware Revision:

These registers are read only and report the current firmware revision of the Mini ATX PSU.

Register 0x31 – Shutdown Delay:

When the power button is depressed for over three seconds, the Mini ATX PSU sends a shutdown signal to the Raspberry Pi. This starts causes the Raspberry Pi to start its shutdown process and send a command to the Mini ATX PSU to extinguish the Boot Ok LED. When the Boot Ok LED is extinguished, the Mini ATX PSU will wait the 'Shutdown Delay' in seconds before powering off the Raspberry Pi.

Register 0x32 – Remote Shutdown Delay:

When the user initiates either a shutdown or reboot from the operating system, the Boot Ok LED extinguishes. The Mini ATX PSU then waits up to the remote shutdown delay in seconds before removing power from the Raspberry Pi. If the Raspberry Pi reboots and the Boot Ok LED illuminates before this delay has expired then power to the Pi is maintained.

Register 0x33 – Remote Shutdown Detect Delay:

When power management is enabled and the Mini ATX PSU senses a remote shutdown, this delays when the Boot Ok LED extinguishes and the Mini ATX PSU begins to wait for a Boot Ok command from the Raspberry Pi. If it does then power is maintained to the Pi. If not, then the power is removed after the remote shutdown delay period has expired.

Register Address 0x34 - Power Management

Bit	7	6	5	4	3	2	1	0
	-	-	-	-	-	-	PWR_MGT_M1	PWR_MGT_M0
Default	0	0	0	0	0	0	0	0

Power Management Mode

PWR_MGT_M1	PWR_MGT_M0	
x	0	Disable power up after power failure
0	1	Enable power up after power failure. Restore power to the Raspberry Pi after power failure whether the Raspberry Pi was powered before power failure.
1	1	Enable power up after power failure. Always restore power to the Raspberry Pi after failure.

By default, power management is disabled on the Mini ATX PSU. To enable this feature, write a value with bit 0 (PWR_MGT_M0) to this register. See above table for behavior of the Mini ATX PSU after restoration of power.

Register Address 0x35 - Watchdog Timer

Bit	7	6	5	4	3	2	1	0
	WD_TMR	Maximum Reboot Attempts						
Default	0	0						

WD_TMR	
0	Watchdog Timer Disabled
1	Watchdog Timer Enabled

By default, the watchdog timer is disabled. To enable the watchdog timer, write the value 0x80 to this register. If you wish for the Raspberry Pi to make multiple attempts to reboot, then set the number of desired attempts in bits 0 – 6. The range is 0 – 127 attempts. So, for example if you wish to make a maximum of two reboot attempts, the value you would write would be 0x82.

Register Address 0x36 - Watchdog Timer Delay

When the watchdog timer is enabled, the Mini ATX PSU waits up to the value of this register in seconds before power cycling the Raspberry Pi if no keep-alive command (0x82) is received.

Register Address 0x37 - Watchdog Timer Reboot Delay

In the event that the watchdog timer expired and the Mini ATX PSU is attempting to reboot the Raspberry Pi, the Mini ATX PSU will wait the value of this register in seconds after rebooting for a keep-alive command. If no keep-alive command is received, then the Mini ATX PSU will power cycle the Raspberry Pi.

Register Address 0x38 - Watchdog Timer Power Cycle Delay

In the event that the watchdog timer expired and the Mini ATX PSU power cycles the Raspberry Pi, the watchdog timer power cycle delay is the period of time, in seconds, that the Mini ATX PSU waits between removing power from the Pi and restoring power. This delay allows any devices that are attached to the Pi or the ATX power supply to fully reset before power is restored.

Register Address 0x39 - I2C Address Register

I2C must be enabled on the Raspberry Pi. Enter “sudo i2cdetect –y 1” in a command window to verify that the Mini ATX PSU is present at the correct address. Changes to this address will require updating the address values in the installed services.

Commands

Process	Address	Read	Write
Reset Default Values	0x80	Read block of current default values	Any value: reset factory defaults
Ping Watchdog Timer Keep Alive	0x82	Returns 0xff	Any Value: reset watchdog timer
Set Boot Ok State	0x83	Returns 0xff	0xx0: Boot Ok on 0xx1: Boot Ok off

Although the mechanism is the same, executing commands is different than reading/writing values to the registers.

When you execute commands on the Mini ATX PSU, you are performing the functions defined in the table above.

Programming the Mini ATX PSU

There are several example Python scripts available at: https://github.com/tomtibbetts/ATX-Watchdog-for-Pi/tree/main/scripts/examples. The Raspbian desktop comes with a Python editor called Thonny in which you can copy and paste the code needed to read/write register values and commands.

In most cases you should be able to use the Mini ATX PSU out of the box without changing any of its operating parameters. If you do need to change something, then it's easy to edit one of the example scripts to your needs and execute it in Thonny.

Enabling the Watchdog Timer

To enable the watchdog timer, you will need to do the following:

1. Install the Keep Alive service. This service will send a Keep Alive command to the Mini ATX PSU at a regular period ensure power to the Raspberry Pi. If the Raspberry Pi freezes and the Mini ATX PSU does not receive the Keep Alive command, then the Mini ATX PSU will power cycle the Raspberry Pi.
2. Enable the watchdog timer.

Installing the Keep Alive service is done much the same way as downloading and executing the original install script.

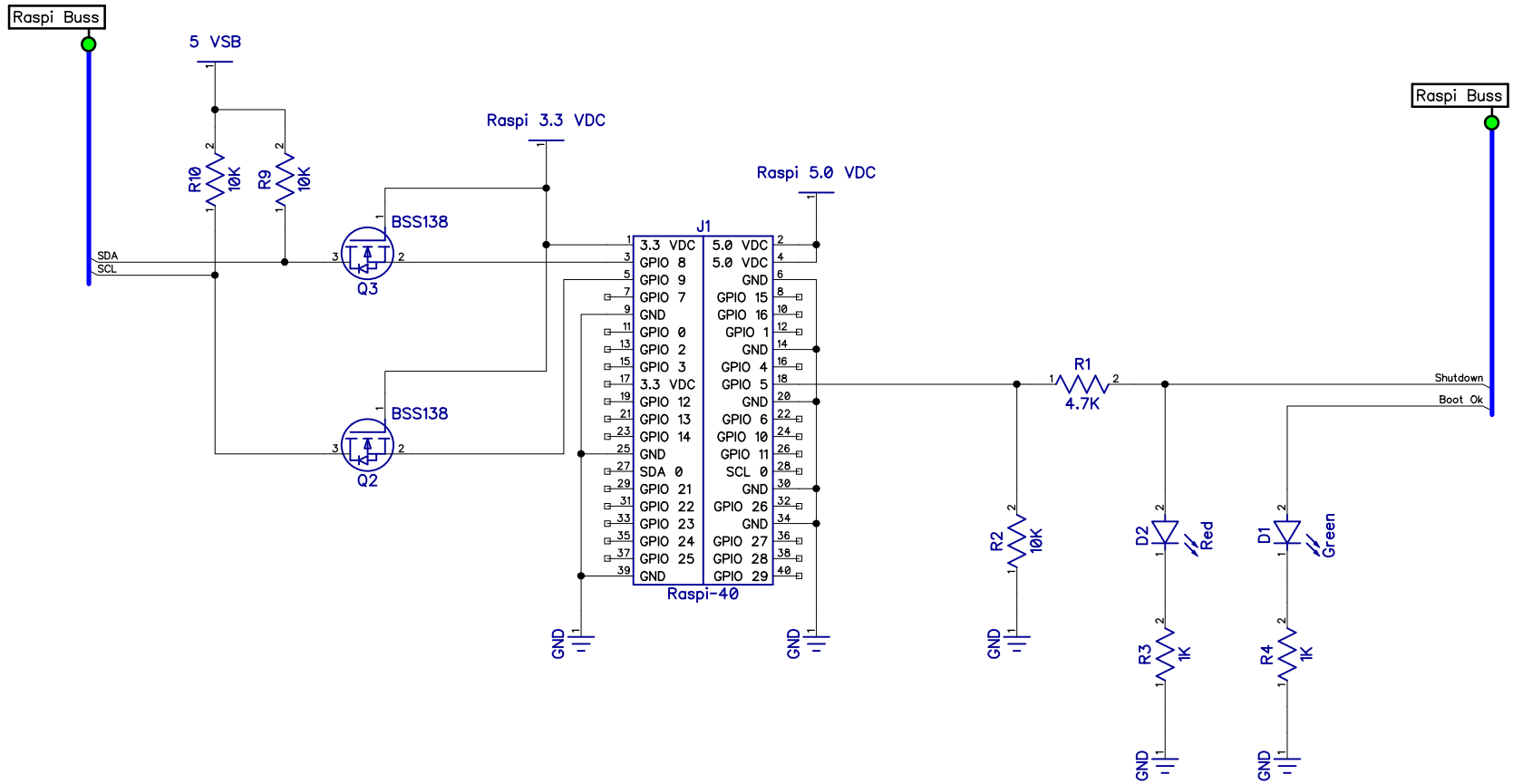
1. Open a command window and enter the following commands:

2. sudo wget https://raw.githubusercontent.com/tomtibbetts/ATX-Watchdog-for-Pi/main/scripts/ATX-Watchdog_Keep_Alive_install.sh. Alternatively, navigate to: https://github.com/tomtibbetts/ATX-Watchdog-for-Pi/blob/main/scripts/ATX-Watchdog_Keep_Alive_install.sh. Click on the "Raw" button. It is found above the script text, on the header to the right. Copy and paste the URL into the command window after "sudo wget " then hit enter.
3. sudo bash ATX-Watchdog_Keep_Alive_install.sh – This will install and start the Keep Alive service.
4. Enable the watchdog timer by setting bit 7 (WD_TMR) of register 0x35. Please see the enableWatchdog.py script in https://github.com/tomtibbetts/ATX-Watchdog-for-Pi/tree/main/scripts/examples
5. sudo rm ATX-Watchdog_Keep_Alive_install.sh to remove the install script.
6. sudo reboot.

Warranty

Unassembled kits are warranted for the parts only as home assembly cannot be controlled. However, if you do find yourself with a non-working board and have exhausted all attempts to fix the issue, then the board may be exchanged for a new kit at a discounted price.

Product that has failed for non-warranted reasons may be exchanged for new or equivalent functionality at a discounted price. Please email us using the "Contact Us" page at http://www.piryteboards.com/ for more details.



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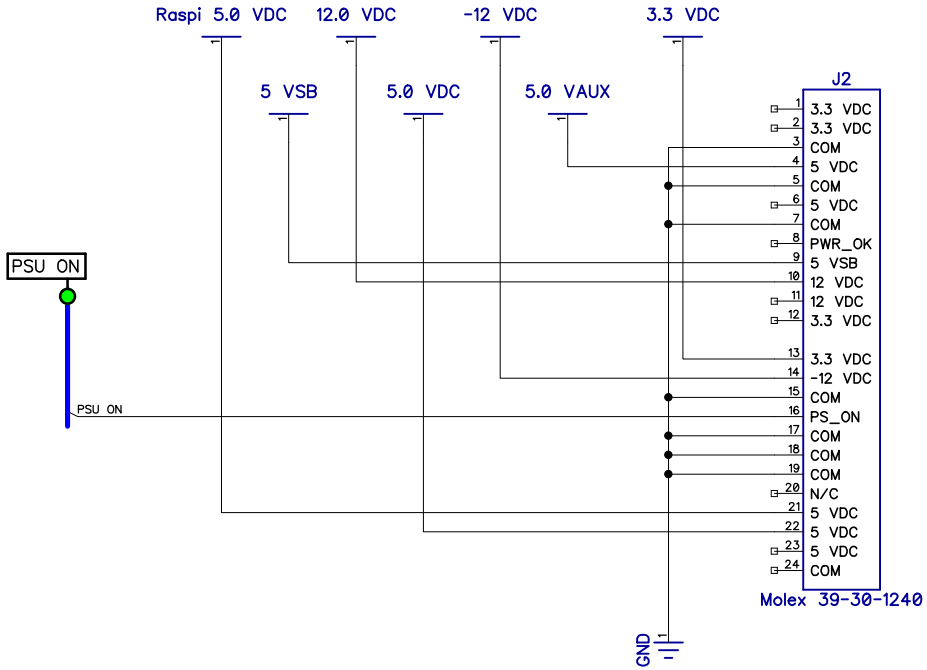
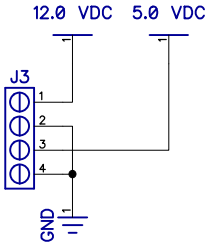
Date: 12/27/2020		Thomas Tibbetts
Filename		Raspi Bus





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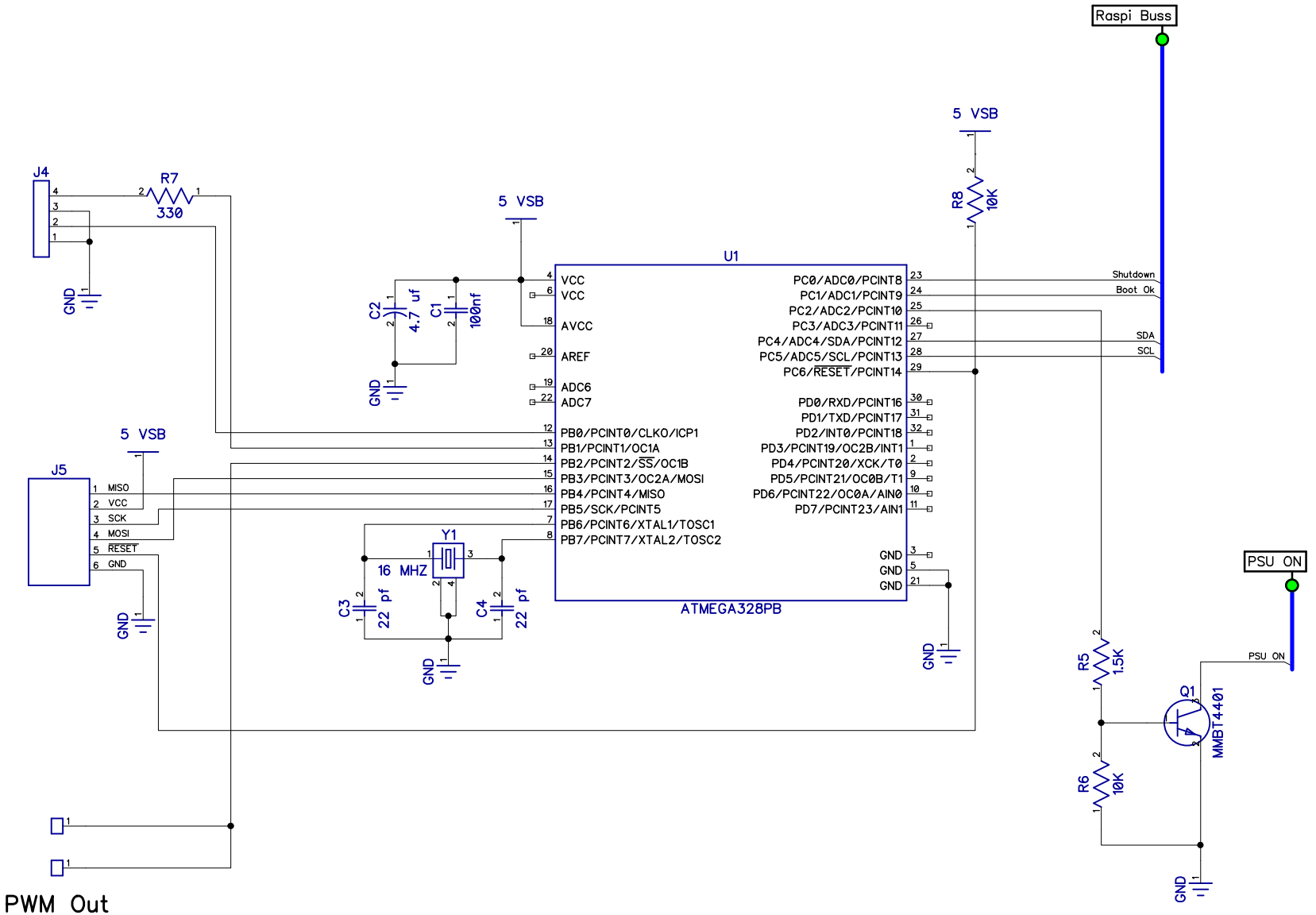
Date: 12/27/2020		Thomas Tibbetts
Filename		ATX PSU



Watchdog ATX PSU 4 Pi		
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Date: 12/27/2020		Thomas Tibbetts
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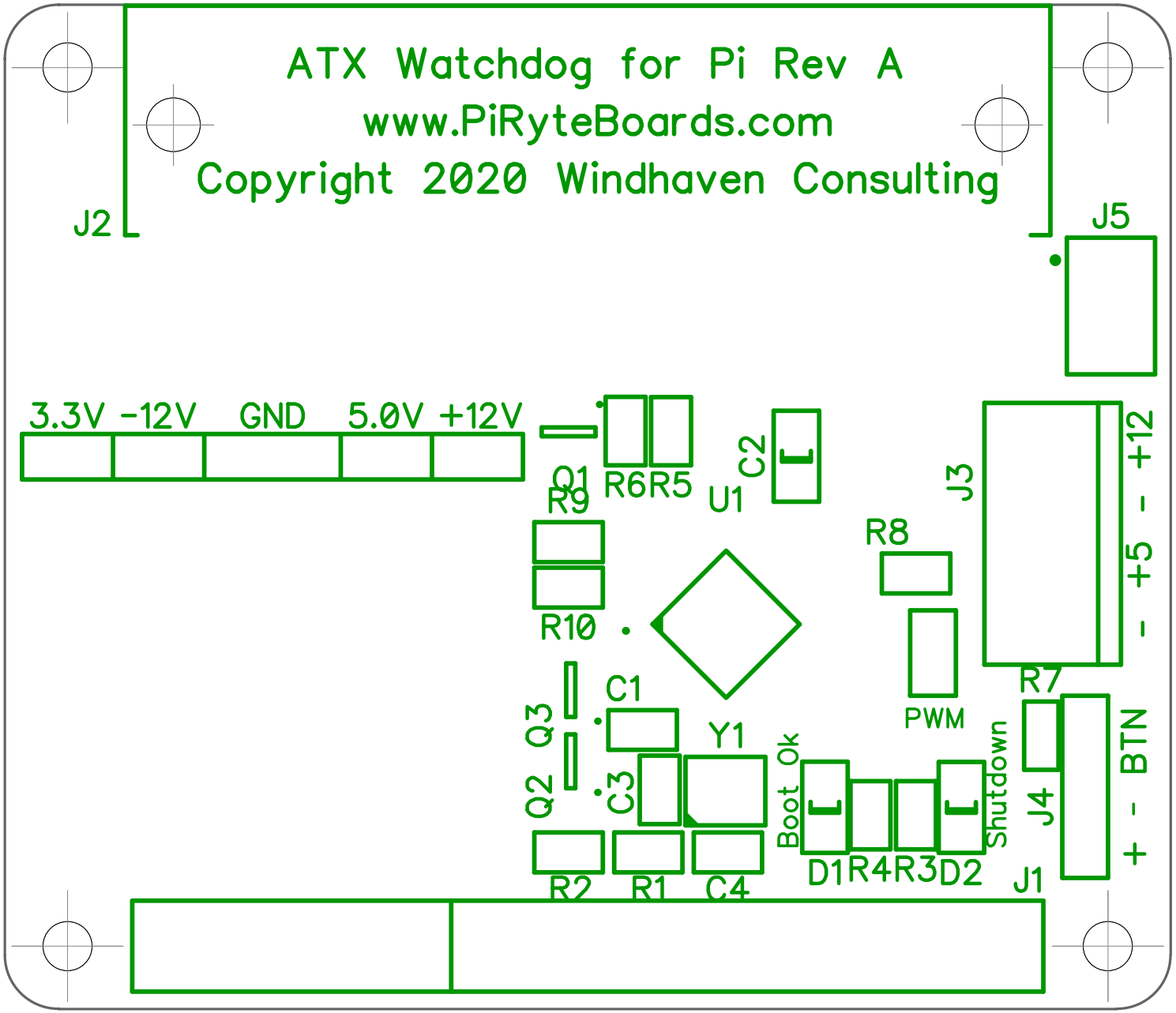
ATX Watchdog for Pi Rev A
www.PiRyteBoards.com
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J2
J5
3.3V -12V GND 5.0V +12V
Q1
R6
R5
U1
C2
J3
- +5 - +12
R9
R8
R10
PWM
R7
C1
Y1
Q3
Q2
C3
Boot Ok
Shutdown
J4
+ - BTN
D1
R4
R3
D2
R2
R1
C4
J1