YAORP (Yet Another Open Reflow Plate)

Issued 2025-03-05

Status: Tested

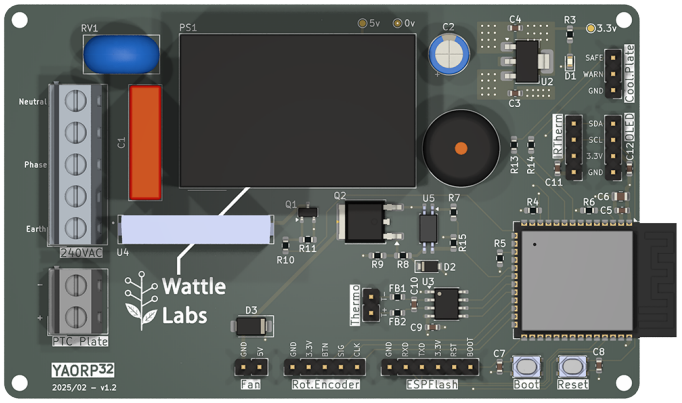
Rev 1.2

PROJECT DESCRIPTION

A design for a solder reflow plate for SMD rework using commonly available aluminium 240V AC 400W PTC (positive temperature coefficient) heating plate from AliExpress.

PTC temperature is determined using an infrared thermometer (MLX90614). The PTC is driven by an SSR (solid state relay) using PWM (pulse width modulation), and controlled by a PID (proportional integral derivative).

An ESP32 S3 Wroom 1 module forms the heart of the design and firmware is written in C++ for Arduino IDE.



PROJECT NOTES

1. This is board 1 of a 2 board design. Board 2 is a heat deflector/cooler to insulate PTC heating plate from mounting box etc.

2. Firmware is developed in C++ using Arduino IDE and has been tested using a protype board version of the project, and is a proof of concept.

PROJECT ARCHITECTURE

Power – 240VAC to 5VDC
Page2
File: sch_power_ACto5VDC.kicad_sch

Power – 3v3DC
Page3
File: sch_power_3v3DC.kicad_sch

MCU – ESP32 S3 Wroom 1
Page2
File: sch_mcu_esp32s3wroom1.kicad_sch

IO – Cooling Fan
Page2
File: sch_io_fan.kicad_sch

PCB – Mounts
Page2
File: sch_pcb_mounts.kicad_sch

IO – PTC Plate
Page2
File: sch_io_ptc.kicad_sch

IO – Misc
Page2
File: sch_io_misc.kicad_sch

DESIGN NOTES KEY

DESIGN NOTE:
Example text for informational design notes.

DESIGN NOTE:
Example text for cautionary design notes.

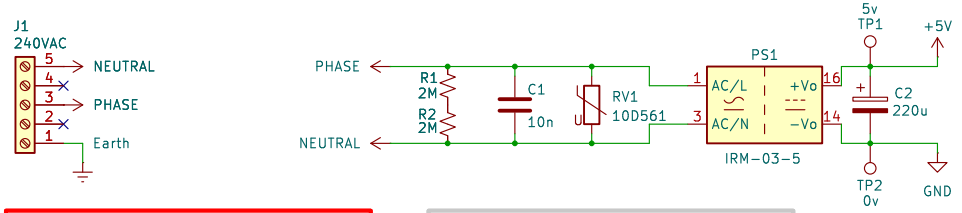
DESIGN NOTE:
Example text for critical design notes.

LAYOUT NOTE:
Example text for critical layout guidelines.

DRAFT – Very early stage of schematic, ignore details.
PRELIM – Close to final schematic.
PROTOTYPE – Untested in its built form.
TESTED – A board with this schematic has been built and tested.

Title: YAORP (Yet Another Open Reflow Plate)			Wattle Labs
Sheet: / File: Board1.kicad_sch			
Rev: 1.2	Date: 2025-03-05	Id: 1/9	KiCad E.D.A. 9.0.0

[2] Mains to 5v DC Power Supply



DESIGN NOTE:

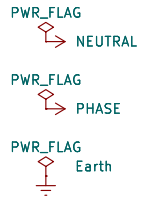
Skipped pins 2&4 on J1 is intended to provide additional trace clearance VS finding a larger part (copper has been removed from PCB holes).

DESIGN NOTE:

Mains side 2A fuse is intended to be offboard (being built into IEC power receptable).

DESIGN NOTE:

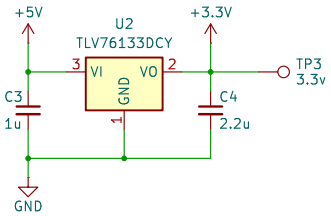
Resolves issues with KiCad ERC



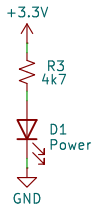
Title: Mains to 5v DC Power Supply			Wattle Labs
Sheet: /Power - 240VAC to 5VDC/ File: sch_power_ACto5VDC.kicad_sch			
Rev: 1.2	Date: 2025-03-05	Id: 2/9	KiCad E.D.A. 9.0.0

[3] 3.3v DC Power Supply

LDO Linear Regulator



Power LED



DESIGN NOTE:

V_{IN}: 2.5V–16V (20V abs max)

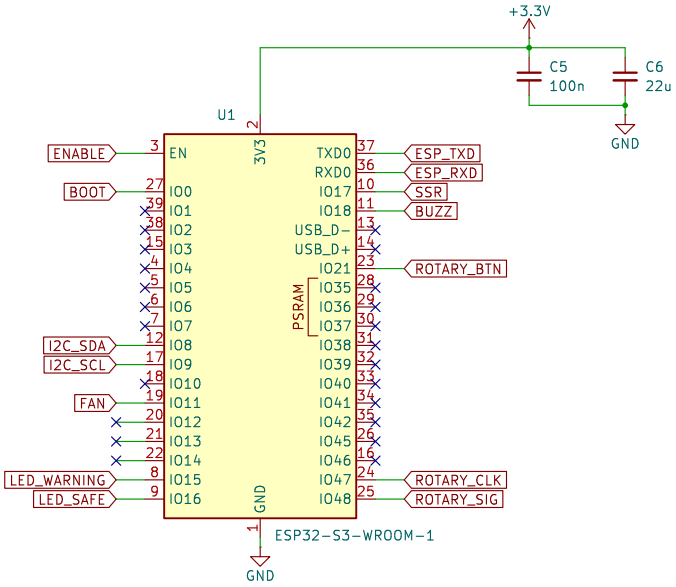
V_{OUT}: fixed 3.3V, max 1A

$V_{DROPOUT}$: 0.6 @ 800mA

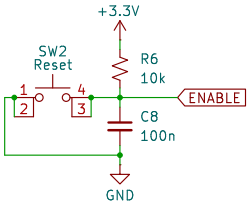
I_Q: 60uA (~1.5uA in shutdown)

Title: 3.3v DC Power Supply			Wattle Labs
Sheet: /Power – 3v3DC/ File: sch_power_3v3DC.kicad_sch			
Rev: 1.2	Date: 2025-03-05	Id: 3/9	KiCad E.D.A. 9.0.0

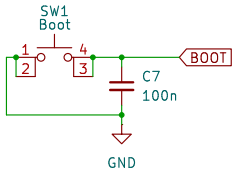
[4] ESP32-S3-WROOM-1 Module



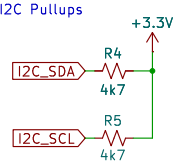
ESP32 Reset



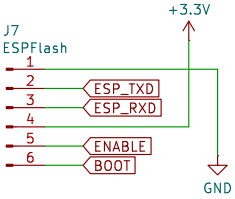
ESP32 Boot



I2C Pullups



ESPFlash Connector

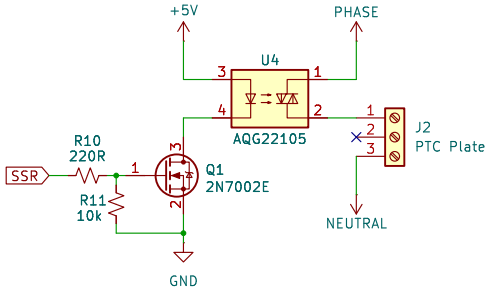


DESIGN NOTE:

This could be removed in favour of a USB connector however cost uplift and slightly more complex to route. The firmware is unlikely to be updated often and after initial flash, could be done OTA.

Title: ESP32-S3-WROOM-1 Module			Wattle Labs
Sheet: /MCU - ESP32 S3 Wroom 1/ File: sch_mcu_esp32s3wroom1.kicad_sch			
Rev: 1.2	Date: 2025-03-05	Id: 4/9	KiCad E.D.A. 9.0.0

[5] Solid State Relay to drive PTC Plate



DESIGN NOTE:

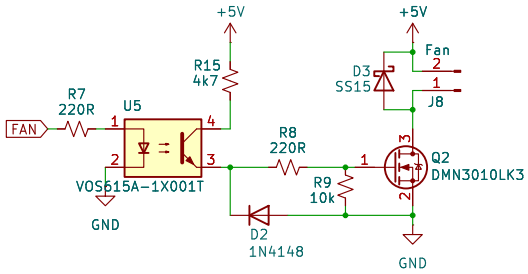
Skipped pin 2 on J2 is intended to provide additional trace clearance VS finding a larger part (copper has been removed from PCB holes).

DESIGN NOTE:

1. SSR is a 5V drive thus MOSFET required to be driven by ESP32 GPIO
2. SSR is a zero crossing type, best suited for the resistive load the PTC plate presents.

Title: Solid State Relay to drive PTC Plate			Wattle Labs
Sheet: /IO – PTC Plate/ File: sch_io_ptc.kicad_sch			
Rev: 1.2	Date: 2025-03-05	Id: 5/9	KiCad E.D.A. 9.0.0

[6] Cooling Fan Driver



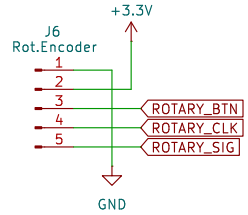
DESIGN NOTE:

Optocoupler used to buffer 3.3v to 5v drive for MOSFET

Title: Cooling Fan Driver			Wattle Labs
Sheet: /IO – Cooling Fan/ File: sch_io_fan.kicad_sch			
Rev: 1.2	Date: 2025-03-05	Id: 6/9	KiCad E.D.A. 9.0.0

[7] Misc I/O

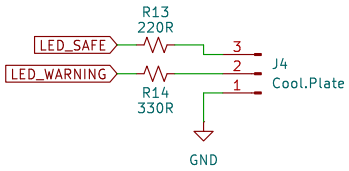
Rotary Encoder Connector



DESIGN NOTE:

Encoder module includes pullups

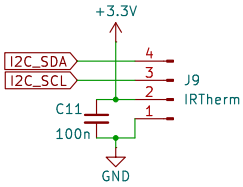
Cooling Plate LED Connector



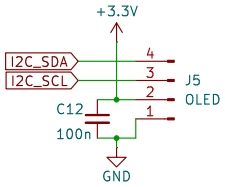
DESIGN NOTE:

LEDs live on a seperate schematic/PCB (board 2)

Cooling Plate IR Thermometer Connector



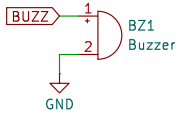
OLED Connector



DESIGN NOTE:

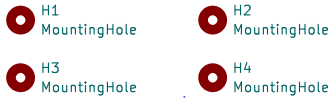
SSD1306 128X64 pixel 1.5" OLED

Buzzer



Title: Misc I/O			Wattle Labs
Sheet: /IO – Misc/ File: sch_io_misc.kicad_sch			
Rev: 1.2	Date: 2025-03-05	Id: 7/9	KiCad E.D.A. 9.0.0

[8] Mounting Holes



Title: Mounting Holes			Wattle Labs
Sheet: /PCB – Mounts/ File: sch_pcb_mounts.kicad_sch			
Rev: 1.2	Date: 2025-03-05	Id: 8/9	KiCad E.D.A. 9.0.0

[99] Revision History

19-Feb-2025 - Rev 1.1
Status: Prototype

* Removed LED for SSR indicator from board2 (and board1 pin header). It was found that this LED reduced the SSR outout and became impossible to get PTC plate to 200degC. Plan to implement a "power meter" bar graph in the OLED to show SSR drive.

* Added InfraRed temperature sensor (MLX90614ESF) to board2 (and board1 pin header). This will read temperature from beneath the hot plate (and is somewhat of an experiement therefore the thermocouple driver remains on board).

* Added ferrite beads to thermocouple inputs to reduce potential for EMI to upset temperature readings.

5-Mar-2025 - Rev 1.2
Status: Prototype

WIP

* Migrate to KiCad 9.

* Resolved ERC warnings on schematic and PCB.

* Fixed missing ground connection for Reset switch.

* Updated font size on pin header labels (JLCPCB was unable to print them at 1x1mm).

* Updated bulk capacitor for the ESP32 module from 10u to 22u 16V (following Espressif best practise). Previous 10u cap had the board not booting due to brownout.

* Updated SSR to a zero crossing type to suit the PTCs resistive load.

* Removed MAX31855 thermocouple chip and associated components. In practise the infrared thermometer performs better.

xx-xxx-20xx
Status: ???

Title: Revision History			Wattle Labs
Sheet: /Revision History/ File: project history.kicad_sch			
Rev: 1.2	Date: 2025-03-05	Id: 99/9	KiCad E.D.A. 9.0.0