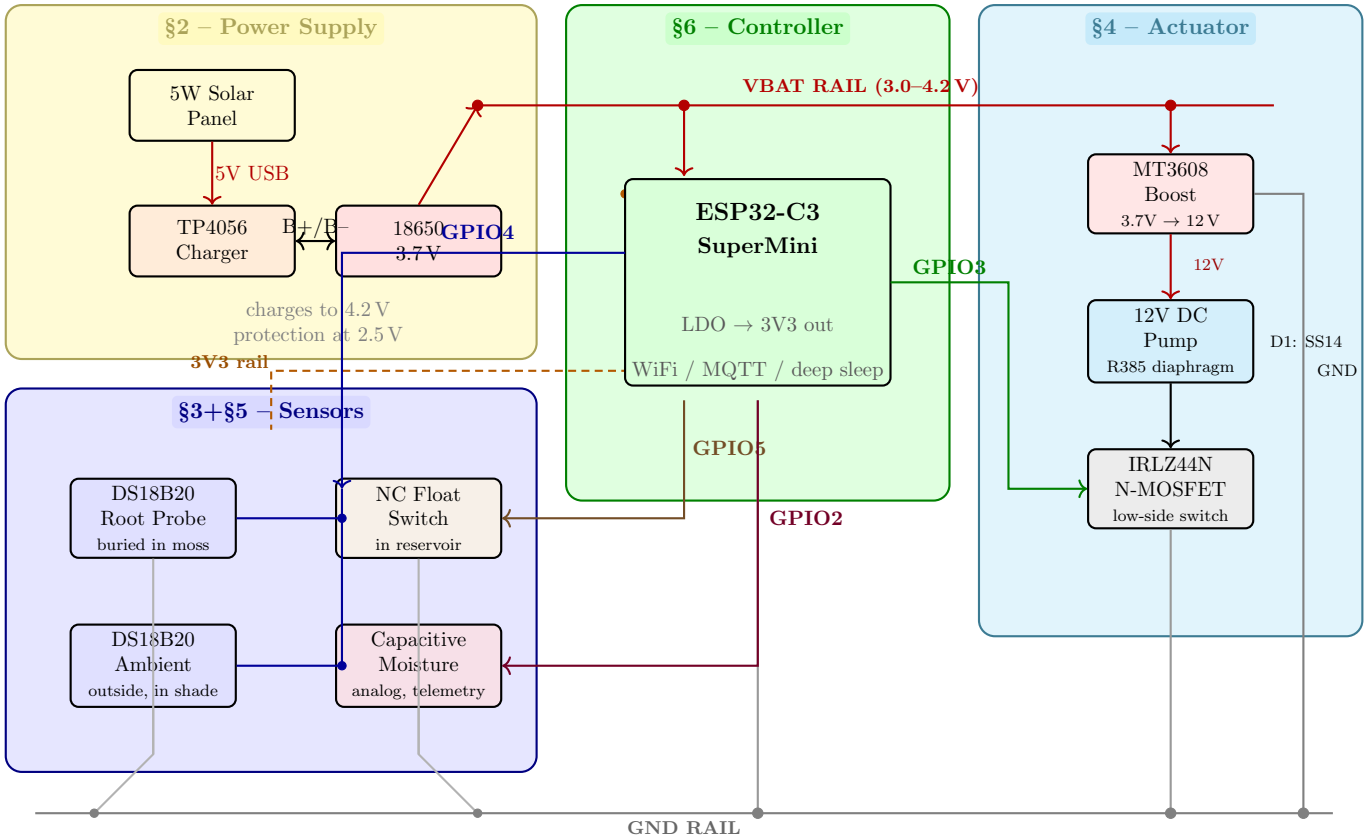
Darlingtonia Zeer Pot

ESP32-C3 Controller — Circuit Schematic

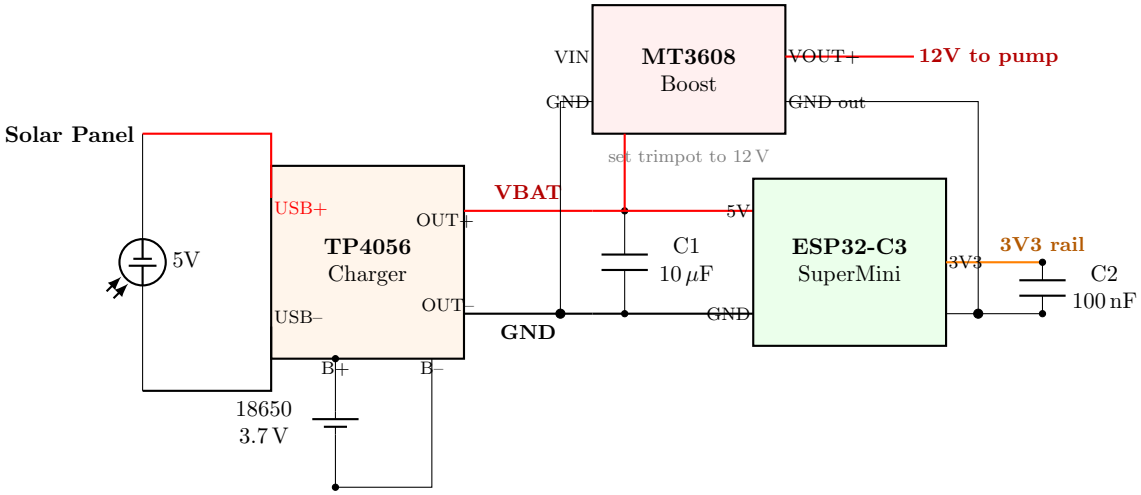
Solar-powered autonomous irrigation with temperature control

1. System Overview



Control logic: Wake → read temps (GPIO4) → read moisture (GPIO2) → check float (GPIO5) → if root >21°C and water OK: drive GPIO3 HIGH, pump 20 s → report MQTT → deep sleep. **Payload:** root, ambient, delta, pump, water, moist_raw, moist_pct, sleep_min, boot.

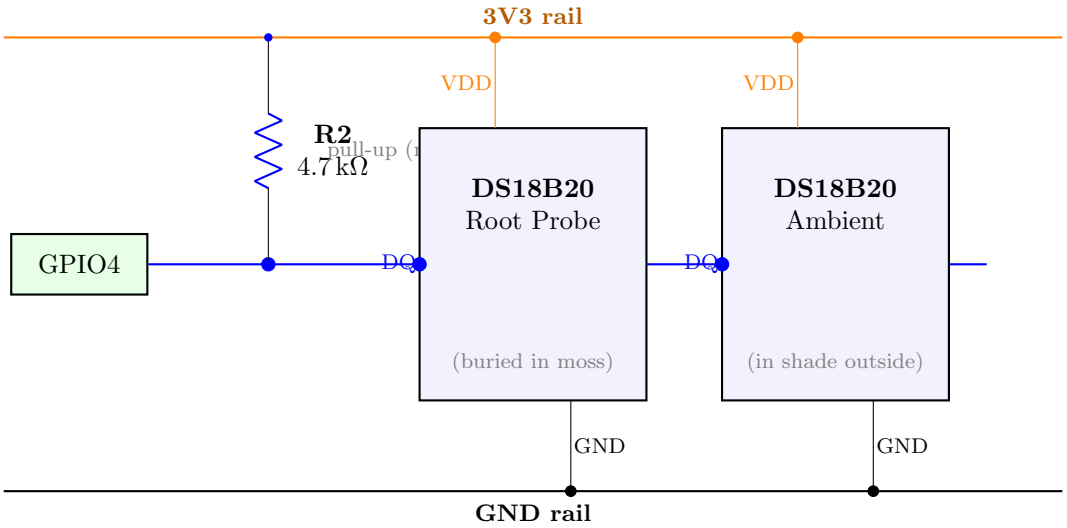
2. Power Supply



What each part does:

- **Solar panel** — 5 W USB-C, charges battery via TP4056.
- **TP4056** — charges 18650 to 4.2 V max; protection cuts off below ∼2.5 V. OUT+/OUT– are the *load output*.
- **C1 (10 µF)** — bulk decoupling on VBAT rail.
- **ESP32-C3** — onboard LDO. Feed VBAT into **5V pin**. **3V3 pin is an output** powering sensors.
- **C2 (100 nF)** — HF decoupling on 3V3 rail.
- **MT3608** — boosts VBAT to stable 12 V for the pump.

3. Temperature Sensors — DS18B20 OneWire Bus



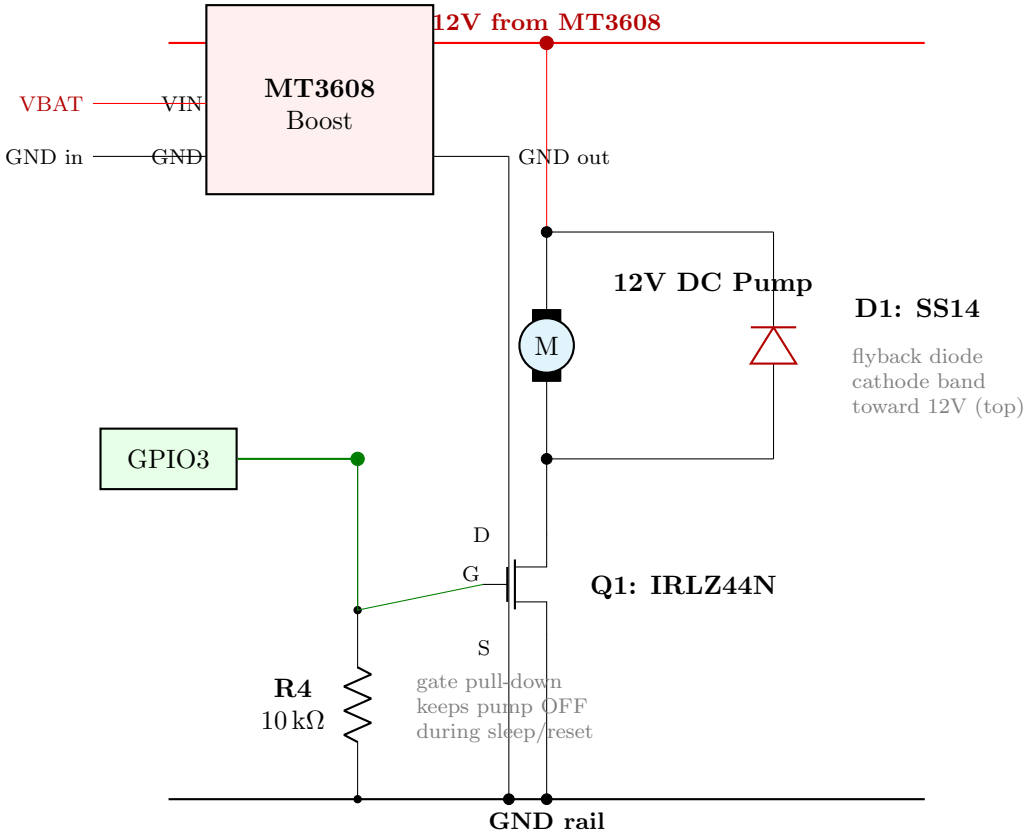
What each part does:

- **DS18B20 Root Probe** — waterproof sensor at root depth in sphagnum moss. Triggers cooling.
- **DS18B20 Ambient** — same sensor in shade outside. Reference for cooling effectiveness.
- **R2 (4.7 kΩ)** — **mandatory** OneWire pull-up. One resistor serves both probes.
- Both probes share GPIO4. Firmware auto-identifies by temperature (cooler = root).

Typical DS18B20 probe wire colors:

Red	→	VDD (connect to 3V3 rail)
Black	→	GND
Yellow or White	→	DQ / Data (connect to GPIO4 bus)

4. Pump Driver — MOSFET Low-Side Switch



What each part does:

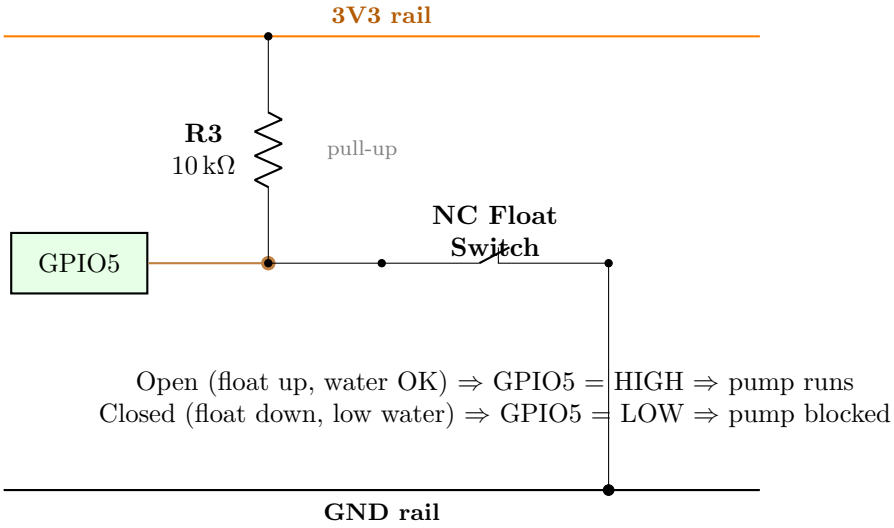
- **IRLZ44N (Q1)** — Logic-level N-MOSFET. Low-side switch. Fully on at 3.3 V gate drive.
- **R4 (10 kΩ)** — Gate pull-down. *Without it, pump could run uncontrolled during boot/sleep.*
- **D1 (SS14)** — Flyback diode. **Cathode** (band) **toward pump+** (top).
- **MT3608** — Boosts VBAT to 12 V for pump.
- **Optional: 100 Ω gate series resistor** — limits inrush from gate capacitance. Good practice, not required.

IRLZ44N pinout (front label facing you, pins down):

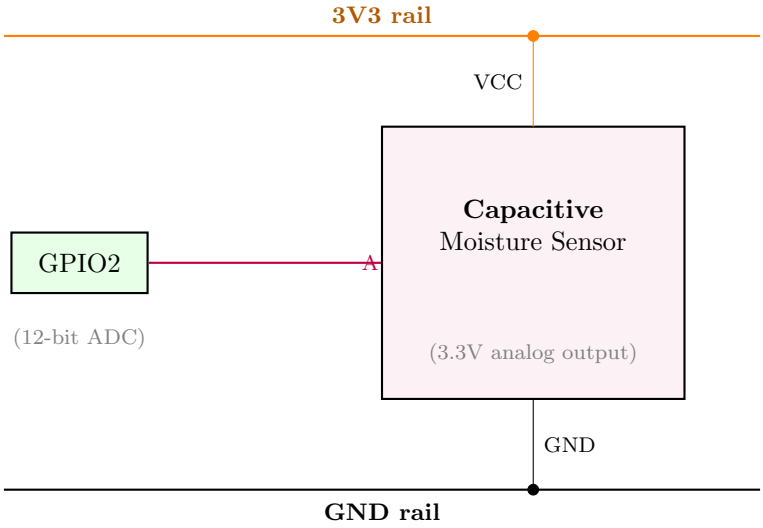
Pin 1	Pin 2	Pin 3
Gate	**Drain**	**Source**
← GPIO3 + R4	← Pump (–)	→ GND

5. Safety & Telemetry — Float Switch + Moisture Sensor

5a. Float Switch (GPIO5) — Low-Water Safety Interlock



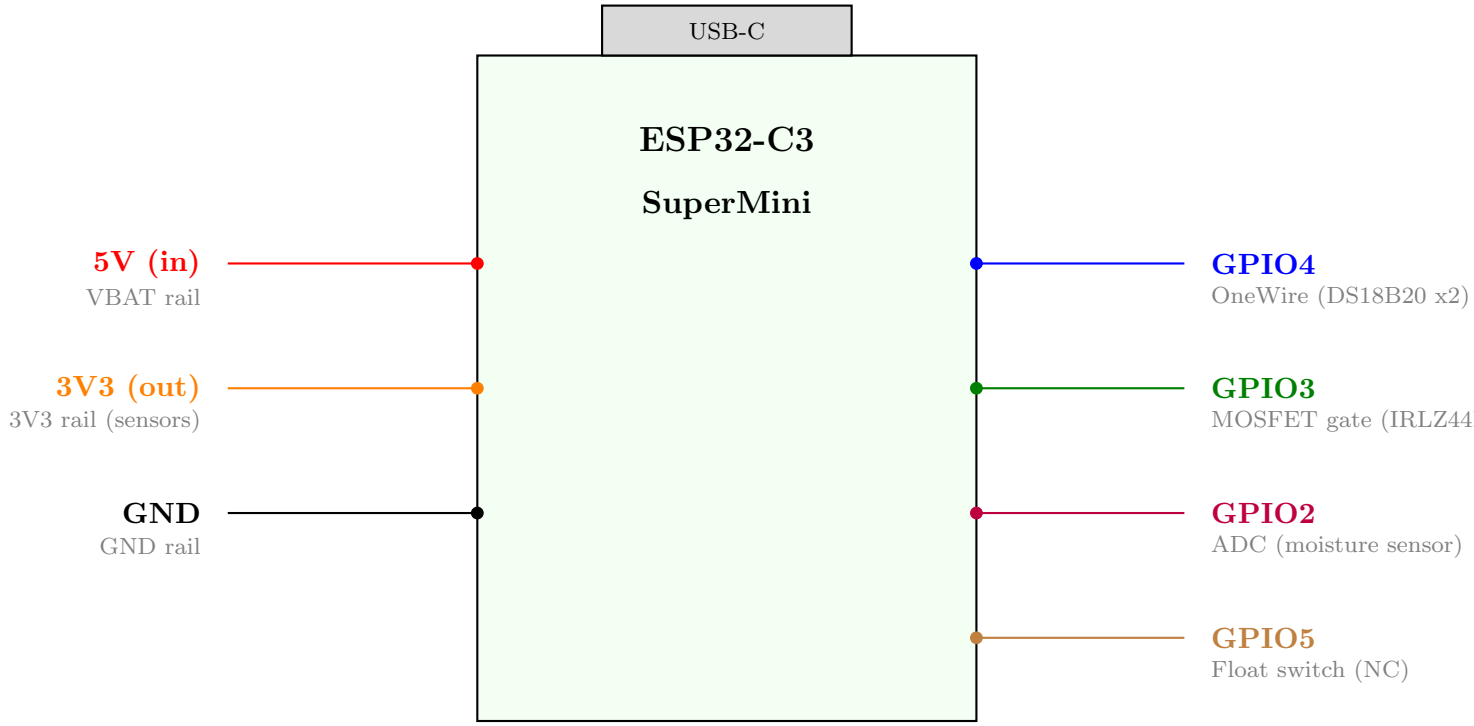
5b. Capacitive Moisture Sensor (GPIO2) — Telemetry Only



What each part does:

- **NC Float Switch** — float up (water present) opens contacts (HIGH). Float down (low water) closes contacts (LOW = pump blocked).
- **R3 (10 kΩ)** — Pull-up to 3V3. When switch opens (water OK), GPIO5 = HIGH. When closed (low water), GPIO5 = LOW. *Note: firmware needs* `waterOk = (digitalRead(5) == HIGH)`.
- **Moisture Sensor** — Capacitive (not resistive!). *Telemetry and calibration only*—pump is temperature-controlled. **No extra resistors needed.**

6. ESP32-C3 SuperMini — Complete Pin Reference



Resistor summary — where each one goes:

Ref	Value	Between	Purpose
R2	4.7 kΩ	GPIO4 ↔ 3V3	OneWire pull-up (mandatory for DS18B20)
R3	10 kΩ	GPIO5 ↔ 3V3	Float switch pull-up (HIGH = water OK)
R4	10 kΩ	GPIO3 ↔ GND	MOSFET gate pull-down (keeps pump OFF during sleep)
C1	10 µF	VBAT ↔ GND	Bulk decoupling for battery rail
C2	100 nF	3V3 ↔ GND	HF decoupling for ESP32 regulator output
D1	SS14	Across pump terminals	Flyback protection (cathode toward 12V/pump+)
Q1	IRLZ44N	Low-side pump switch	N-MOSFET, gate driven by GPIO3