Archived source document. Publication links are updated; scientific text and reported values are retained. Raw and complete data remain in the unpublished Zenodo preparation package.

Component calculations and inventory

Return to Hardware build resources

Component selection audit

The audit maps all 104 reference designators to 28 functional groups. Values printed on sheet 2 are calculated below. Sheet 1 leaves C1–C11, R1–R14 and L1 values blank and does not identify U3; those entries show the applicable selection equation or manufacturer requirement instead of an invented value.

Table 4. Full selection audit · 61 BOM rows

Function and references	Nominal value	Equation and substitution	Selection basis and source
TIA feedback **R27, C21**	100 MΩ; 2.2 pF	Zf=Rf/(1+j2πfRfCf); τ=100 MΩ×2.2 pF=220 µs; fp=723.43 Hz. Gain magnitude at 41/67/89/113 Hz: 99.84/99.57/99.25/98.80 MΩ.	Rf sets current-to-voltage scale; Cf limits feedback impedance at high frequency. At 300 K, Rf alone contributes √(4kT/Rf)=12.87 fA/√Hz; ideal one-pole integrated output noise is 43.39 µV RMS. This is one noise term, not detection limit. Schematic sheet 2, TIA; LMP7721 Rev. E pp. 17–19, 22–24 [7]
Photocurrent and input stability **D5, U8**	VEMD5060X01; LMP7721	Cd≈80 pF at zero bias; amplifier input≈11 pF; Cin≈91 pF+layout. Noise gain NG(s)=1+sRfCin/(1+sRfCf), approaching 1+Cin/Cf≈42.4 before layout capacitance.	D5 cathode connects to IN− and anode to ground, giving positive output for photocurrent leaving the summing node. LMP7721 has 3 fA typical bias at specified test conditions. Phase margin requires its open-loop response and actual parasitics; the 723 Hz feedback pole alone does not prove stability. Schematic sheet 2; VEMD5060X01 Rev. 1.2 p. 2; LMP7721 Rev. E pp. 6–7, 18–19 [10] [7]
ADC differential input network **R29, R36, C24**	100 Ω + 100 Ω; 1000 pF	Rdiff=R29+R36=200 Ω; τ=200 Ω×1 nF=0.200 µs; fp=795.8 kHz (unloaded differential model).	C24 spans AINP and AINN. Both series resistances enter the differential calculation. The network isolates sampling charge; it is not a 2 kHz anti-alias filter. U8 directly drives it; no separate voltage-gain stage is shown. Schematic sheet 2, TIA and ADC; ADS8866 Rev. C analog-input and input-driver sections [8]

Function and references	Nominal value	Equation and substitution	Selection basis and source
Digitization **U9**	ADS8866IDGS	LSB=2.5 V/65536=38.147 µV; DC current/code=LSB/100 MΩ=0.38147 pA; ideal span=2.5 V/100 MΩ=25 nA.	16-bit, 100 kSPS device; the firmware selects 4 kSPS. Actual headroom uses U8 output limits, offsets and total DC photocurrent. Resolution is not accuracy, sensitivity or usable rail-to-rail range. Schematic sheet 2; ADS8866 Rev. C pp. 5–9, 18–20; firmware main.cpp [8]
Excitation current **R16, R21, R24, R30, D1, D2, D3, D4**	100 Ω each; 155124BS73200	I≈(5−Vf−VDS)/100 Ω. Using Vf=3.4 V at the manufacturer's 20 mA test point and neglecting VDS gives 16 mA; resistor power≈25.6 mW on, 6.4 mW at 25% duty.	This is an operating-point estimate: Vf changes with current and temperature. Datasheet Vf maximum 3.8 V is specified at 20 mA; no minimum is given, so it does not establish a complete current range. Use actual rail, LED I–V curve and resistor tolerance for limits. Schematic sheet 2, LEDs; Würth 155124BS73200 electrical/optical table p. 2; firmware duty=25 [9]
LED switching **R17, R22, R25, R32, R20, R23, R26, R33, Q1, Q2, Q3, Q4**	220 Ω gates; 100 kΩ pulldowns; AO3400A	Vgate≈3.3×100000/(100000+220)=3.293 V; initial ideal gate current≤3.3/220=15 mA; pulldown current≈32.9 µA. With Ciss=630 pF, 220 Ω×Ciss≈0.139 µs is a small-signal estimate.	220 Ω limits edge current; 100 kΩ holds the gate low when GPIO is undriven. AO3400A specifies RDS(on)≤48 mΩ at VGS=2.5 V, ID=3 A, 25°C. Threshold voltage alone is not an on-state specification; GPIO impedance and Miller charge alter switching time. Schematic sheet 2; AO3400A Rev. 3.1 p. 2 [17]
LED supply reservoir **C12**	47 µF	ΔV≈ΣIΔt/C. Example: four 16 mA channels for 100 µs without replenishment give 0.064×100 µs/47 µF≈0.136 V.	A local transient reservoir, not storage for an entire LED pulse. Actual droop depends on the boost source, ESR and wiring. Schematic sheet 2, "Place near by LEDs"; charge balance Q=CΔV
TIA supply filter **R31, C25, C26**	100 Ω; 0.1 µF + 100 µF	τ=100×100.1 µF=10.01 ms; fp≈15.90 Hz. DC drop=100 Ω×IU8; 1.1 mA gives 0.11 V.	This pole belongs to the supply, not the photometry signal. 1.1 mA is LMP7721 typical quiescent current at 2.5 V; exact 3.3 V board drop includes load current and component variation. Schematic sheet 2, TIA; LMP7721 Rev. E p. 7, p. 25 [7]
ADC rail decoupling **C27, C29**	1 µF each	C27: DVDD to ground; C29: AVDD to ground. Local transient relation ΔV≈IΔt/C; no numerical droop without current and impedance.	Separate digital and analog supplies feed their respective ADC pins. Placement and effective capacitance matter more than an invented signal cutoff. Schematic sheet 2; ADS8866 Rev. C power-supply recommendations [8]

Function and references	Nominal value	Equation and substitution	Selection basis and source
2.5 V reference **U7, C22, C23, R28**	LTC6655BHMS8-2.5; 0.1 µF; 10 µF; 10 kΩ	B-grade initial tolerance: ±0.025%×2.5 V=±625 µV; 2 ppm/°C maximum temperature coefficient. R28 pulls SHDN high. C22 input bypass; C23 output reservoir.	Manufacturer requires input≥0.1 µF and output 2.7–100 µF with low ESR. C23=10 µF is within that nominal range. Reference tolerance contributes gain error; it is not ADC code width. Schematic sheet 2, 2V5_REF; LTC6655 Rev. J pp. 4–5, 12–14 [6]
ADC reference charge reservoir **R34, C28**	0.1 Ω; 10 µF	Zbranch=0.1 Ω+1/(j2πf×10 µF). The equality |XC|=R occurs at 159.2 kHz; this is not a REF-feed low-pass cutoff.	The schematic connects REF directly to VREF_2V5. R34 is in the capacitor-to-ground branch and adds damping/series resistance to local charge storage. Schematic sheet 2, ADC; ADS8866 Rev. C voltage-reference section [8] [6]
ADC mode and digital edges **R35, R37, R38**	10 kΩ; 47 Ω; 47 Ω	R35 holds DIN high for 3-wire CS mode; 3.3 V/10 kΩ=330 µA if pulled low. For source termination, Rseries≈Zline−Rdriver; the schematic specifies 47 Ω but does not provide either impedance.	47 Ω provides series damping on SCLK and CONVST. The precise damping choice and edge response require line capacitance and driver impedance. Schematic sheet 2; ADS8866 Rev. C 3-wire CS-mode timing; firmware main.cpp [8]
Reset and boot **R15, C15, C16, SW2, SW3**	10 kΩ; 0.1 µF + 10 µF; tactile switches	C15 and C16 share EN-to-ground: τ=10 kΩ×10.1 µF=101 ms. V_EN(t)=3.3(1−e^(−t/τ)) for an ideal supply step.	SW2 grounds EN to reset; SW3 grounds GPIO0 to select download mode during reset. The RC time constant is not a guaranteed boot delay; rail ramp and EN thresholds also matter. Schematic sheet 2; Espressif ESP32 Hardware Design Guidelines, Chip power-up and reset timing [19]
Controller supply and timing **C13, C14, U4**	22 µF; 0.1 µF; ESP32-WROOM-32E	Local bulk+high-frequency bypass. Firmware Fs=4000 Hz, N=8000: Ts=250 µs, block=2 s, Δf=0.5 Hz; 41/67/89/113 Hz complete 82/134/178/226 cycles per block.	The timer updates four LED GPIOs and notifies the ADC task. Frequencies are fixed; default duty is 25%, accepted range 1–50%. Capacitance does not by itself prove supply transient compliance. Schematic sheet 2; firmware main.cpp timerISR/sampleTask; Espressif power-supply guidelines [19]
Digital 3.3 V rail **U5, C17, C18**	EC50117KBG; 10 µF; 22 µF	Fixed 3.3 V variant; first-order dissipation P≈(5−3.3)I=1.7I W, e.g. 0.34 W at an illustrative 0.20 A load.	Manufacturer typical application uses 10 µF input/22 µF output. Package thermal resistance and actual load limit usable current; the 1 A family rating is not the board power budget. Schematic sheet 2, 3V3 LDO; E-CMOS EC50117 Rev. F004 pp. 2–3, 5–6 [18]

Function and references	Nominal value	Equation and substitution	Selection basis and source
Analog 3.3 V rail **U6, C19, C20**	LP5907MFX-3.3; 1 µF each	Fixed 3.3 V, up to 250 mA device rating. P≈1.7I W; nominal C19/C20=1 µF.	TI specifies nominal 1 µF input/output capacitors, effective capacitance >0.7 µF across operating conditions, and 5–500 mΩ ESR. Part number, bias derating and layout are needed to check the fitted capacitors. Schematic sheet 2; LP5907 Rev. Q pp. 6, 13–15 [5]
Boost voltage **R6, R8, U1**	R6/R8 unspecified; TPS61023	Vout=VFB(1+R6/R8). At PWM VFB,typ=0.595 V, nominal 5 V requires R6/R8=5/0.595−1=7.403. R8<300 kΩ is manufacturer guidance.	The schematic names the output 5V but supplies neither resistor value. TPS61023 specifies 2.7 A minimum/3.7 A typical valley switch limit under stated conditions, not 3.7 A available at the 5 V output. Schematic sheet 1; TPS61023 Rev. B p. 5, p. 13 Eq. 4 [2]
Boost energy storage **L1**	Unspecified	IL,avg=Vout Iout/(ηVin); ΔIL=Vin D/(Lfsw); IL,pk=IL,avg+ΔIL/2; Isat>IL,pk. Manufacturer L range: 0.37–2.9 µH.	L1 selection requires inductance, saturation-current rating, minimum battery voltage, maximum load and efficiency; these values are not specified in the released schematic.
Boost input and output storage **C2, C3, C4, C5**	Unspecified	C2=input; C3+C4+C5=output. Cout≥Iout D/(fsw ΔVpp); include ESR ripple IL,pk×ESR and bias derating.	TI gives 10 µF as a typical input choice and 4–1000 µF effective output range. The source provides no fitted capacitance or allowable ripple for these positions. Schematic sheet 1; TPS61023 Rev. B pp. 14–15, Eqs. 8–9 [2]
Charge and input limits **R1, R2, R3, U2**	R1/R2/R3 unspecified; BQ24074	EN2=high, EN1=low: ICHG=890 AΩ/R3; IIN,limit=KILIM/R2; ITERM=0.030 A×R1/R3. KILIM typical=1610 AΩ for 0.5–1.5 A, 1525 AΩ for 0.2–0.5 A.	R3 range 590 Ω–8.9 kΩ; R2 1.1–8 kΩ; R1<15 kΩ. Values are absent, so no numerical charging current follows from this BOM. Battery and USB source capabilities also constrain settings. Schematic sheet 1; BQ24074 Rev. N pp. 10, 12–13, 23, 25, 27; Eqs. 1, 2, 5 [3]
Charger bypass **C1, C6, C8**	Unspecified	C6 bypasses IN; C1 bypasses OUT; C8 bypasses BAT. Manufacturer ranges: IN 1–10 µF; OUT/BAT 4.7–47 µF.	These are manufacturer requirements, not fitted board values. Capacitor voltage rating and input inrush must also be checked. Schematic sheet 1; BQ24074 Rev. N pp. 7–8, 23, 34 [3]
Power and charge indicators **DPS1, DPS2, R5, R7**	Generic LEDs; resistors unspecified	R=(Vsource−VLED−VOL)/ILED; P=ILED²R. DPS1/PGOOD uses R5; DPS2/CHG uses R7.	Open-drain status sinks need LED voltage, intended indicator current and resistor values. The source supplies none of those selection parameters. Schematic sheet 1; BQ24074 Rev. N pp. 7–8, 28 [3]

Function and references	Nominal value	Equation and substitution	Selection basis and source
Charger TS bias **R9**	Unspecified	VTS≈75 µA×R9. Nominal hot/cold thresholds 0.3/2.1 V correspond to 4/28 kΩ.	A fixed resistor is drawn; an NTC type or actual value is not specified. Do not interpret this as a measured battery-temperature sensor. Schematic sheet 1; BQ24074 Rev. N pp. 13, 29–30 [3]
Power enable **R4, R11, SW1**	Unspecified; slide switch	SW1 routes source rail through R4 to EN; R11 pulls down. With only these branches, VEN=Vsource R11/(R4+R11).	U3 also connects to EN. Without U3 identity and resistor values, the switch threshold/timing cannot be calculated. TPS61023 requires EN≥1.2 V to enable under its specified conditions. Schematic sheet 1; TPS61023 Rev. B p. 5 [2]
Unidentified control network **U3, R10, R12, C7, C9, C10, C11**	Unspecified	R10/R12 feed U3 P2; C9 shunts that node. C7 bypasses P1; C11/P4 and C10/P6 connect to ground. No function or timing is assigned without the IC pin definition.	The schematic uses generic P1–P6 labels and the BOM leaves U3 blank. Values and a manufacturer part number are needed to complete this calculation. Schematic sheet 1 and BOM rows 7, 9–11, 39, 41, 55
USB power input **R13, R14, J2**	Resistors unspecified; USB-C receptacle	R13 connects CC1 to ground and R14 connects CC2 to ground. Values and tolerance are not stated; no current-advertisement result can be calculated.	J2 supplies 5V_USB; USB data lines are unconnected. The receptacle is a power input, not the UART flashing connection. Schematic sheet 1, USB-C
Battery and UART connections **J1, J3**	Battery_Case; CON4	J1 connects BAT and ground. J3 pins: 1=3V3_DIG, 2=TXD0, 3=RXD0, 4=GND. No gain/current-setting equation applies.	Connector pitch, current rating, polarity and mating part must come from the selected connector, not the generic symbol. Schematic sheets 1–2; BOM rows 25, 27
Fiducials and mounting holes **FD1, FD2, FD3, FD4, FD5, FD6, FD7, FD8, H1, H2, H3, H4**	FD_040; CON	Eight optical fiducials and four mounting holes; no electrical transfer or component-value calculation applies.	Their criteria are board assembly alignment and mechanical clearance. Schematic sheet 1; BOM rows 23–24

Complete PCB inventory

The inventory lists all 61 BOM rows with supplier references, quantities and available specifications. U3 has no quoted price; unspecified values are identified in the source.

Table 5. PCB component inventory · 61 source rows

Reference	Quantity	Component	Vendor value / specification	Unresolved details
C1	1	Capacitor (value not supplied)	No capacitance is given in the vendor BOM or schematic.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR

Reference	Quantity	Component	Vendor value / specification	Unresolved details
C2	1	Capacitor (value not supplied)	No capacitance is given in the vendor BOM or schematic.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C3	1	Capacitor (value not supplied)	No capacitance is given in the vendor BOM or schematic.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C4	1	Capacitor (value not supplied)	No capacitance is given in the vendor BOM or schematic.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C5	1	Capacitor (value not supplied)	No capacitance is given in the vendor BOM or schematic.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C6	1	Capacitor (value not supplied)	No capacitance is given in the vendor BOM or schematic.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C7	1	Capacitor (value not supplied)	No capacitance is given in the vendor BOM or schematic.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C8	1	Capacitor (value not supplied)	No capacitance is given in the vendor BOM or schematic.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C9	1	Capacitor (value not supplied)	No capacitance is given in the vendor BOM or schematic.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C10	1	Capacitor (value not supplied)	No capacitance is given in the vendor BOM or schematic.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C11	1	Capacitor (value not supplied)	No capacitance is given in the vendor BOM or schematic.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C12	1	47 µF capacitor	47uF Vendor nominal capacitance: 47uF.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR

Reference	Quantity	Component	Vendor value / specification	Unresolved details
C13,C18	2	22 µF capacitor	22uF Vendor nominal capacitance: 22uF.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C14,C15,C22,C25	4	0.1 µF capacitor	0.1uF Vendor nominal capacitance: 0.1uF.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C16,C17,C23,C28	4	10 µF capacitor	10uF Vendor nominal capacitance: 10uF.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C19,C20,C27,C29	4	1 µF capacitor	1uF Vendor nominal capacitance: 1uF.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C21	1	2.2 pF capacitor	2.2pF Vendor nominal capacitance: 2.2pF.	Confirm MPN/package,dielectric/leakage and parasitic capacitance
C24	1	1000 pF capacitor	1000pF Vendor nominal capacitance: 1000pF.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
C26	1	100 µF capacitor	100uF Vendor nominal capacitance: 100uF.	Confirm MPN,case/height,voltage,tolerance,dielectric and ESR
DPS1,DPS2	2	Status indicator LED	LED Two LEDs; color/model unspecified	Confirm MPN,color,package/height,current and brightness
D1,D2,D3,D4	4	Side-view blue LED	155124BS73200 155124BS73200; 1204 side-view; at 20mA, typical peak468nm/dominant470nm	Verify orientation/height,optical axis,actual current and optical power
D5	1	Silicon PIN photodiode	VEMD5060X01 VEMD5060X01; top-view SMD5×4×0.9mm; active area7.5mm²	Verify offset active area,assembled height and filter obscuration
FD1,FD2,FD3,FD4,FD5,FD6,FD7,FD8	8	SMT fiducials (PCB features)	FD_040 (SMT optical fiducial) FD_040; eight PCB fiducials	Geometry/mask opening from fabrication data;not separately purchased

Reference	Quantity	Component	Vendor value / specification	Unresolved details
H1,H2,H3,H4	4	PCB mounting holes	CON (standoff hole) H1–H4; vendor-designated standoff holes	Confirm hole/plating/copper keepout;do not double-count screws
J1	1	Battery holder / two-terminal battery connection	Battery_Case Battery_Case; pin1=BAT, pin2=GND; physical model unspecified	Confirm MPN,cell size/protection,polarity/height and charger settings
J2	1	USB Type-C receptacle	USB TYPE C FEMALE Type-C receptacle; VBUS=5V_USB; D+/D− unconnected	Confirm MPN,opening/height/ratings and CC resistors
J3	1	Four-pin UART header	CON4 (4-pin header) 4pins:1=3V3_DIG, 2=TXD0, 3=RXD0, 4=GND	Confirm MPN,pitch/height/orientation and mating cable
L1	1	Boost power inductor	L1; inductance and model unspecified	Confirm inductance,current,DCR,package/height and MPN
Q1,Q2,Q3,Q4	4	N-channel power MOSFET	AO3400A AO3400A; 30V N-MOSFET; SOT-23	Verify package pinout,actual current and temperature rise
R1	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R2	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R3	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R4	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R5	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating

Reference	Quantity	Component	Vendor value / specification	Unresolved details
R6	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R7	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R8	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R9	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R10	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R11	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R12	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R13	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R14	1	Resistor (value not supplied)	No resistance is given in the vendor BOM or schematic.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R15,R28,R35	3	10 kΩ resistor	10k Vendor nominal resistance: 10k.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R16,R21,R24,R29,R30,R31,R36	7	100 Ω resistor	100R Vendor nominal resistance: 100R.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating

Reference	Quantity	Component	Vendor value / specification	Unresolved details
R17,R22,R25,R32	4	220 Ω resistor	220R Vendor nominal resistance: 220R.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R20,R23,R26,R33	4	100 kΩ resistor	100k Vendor nominal resistance: 100k.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R27	1	100 MΩ resistor	100M Vendor nominal resistance: 100M.	Confirm MPN/package,ratings/tolerance,leakage and noise
R34	1	0.1 Ω resistor	0.1R Vendor nominal resistance: 0.1R.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
R37,R38	2	47 Ω resistor	47R Vendor nominal resistance: 47R.	Confirm MPN,case/height,power,tolerance,TCR and voltage rating
SW1	1	Power-enable selector switch	SW1 COMM/B/A contacts; A unconnected; physical model unspecified	Confirm MPN,type,actuator/travel,ratings and opening
SW2,SW3	2	Tactile pushbutton	Tactile_Switch SW2/SW3 tactile buttons; ground signal when pressed	Confirm MPN,package/height,actuation force and contact ratings
U1	1	Synchronous boost converter	TPS61023 TPS61023; synchronous boost; 6-pin SOT-563(DRL)	Confirm ordering suffix/external values;5V/fan margin unverified
U2	1	Single-cell lithium charger / power-path IC	BQ24074 BQ24074; single-cell Li-ion/Li-poly, 4.2V charging; 16-pin VQFN(RGT)	Confirm suffix,R1–R3/R9 and battery/thermal configuration
U3	1	Unidentified six-pin IC	U3 only labelsP1–P6; model, pin functions, package unknown	Vendor must identify model,function,package and external values
U4	1	Wi-Fi / Bluetooth microcontroller module	ESP32-WROOM-32E ESP32-WROOM-32E; 2.4GHz wireless; 3.3V system; onboard antenna	Confirm memory variant,antenna keepout and assembled height

Reference	Quantity	Component	Vendor value / specification	Unresolved details
U5	1	3.3 V digital-supply LDO	EC50117KBG EC50117KBG; fixed3.3V LDO; SOT-223	Verify C17/C18,thermal design and available current
U6	1	3.3 V low-noise analog-supply LDO	LP5907MFX-3.3/NOPB LP5907MFX-3.3/NOPB; 3.3V/250mA LDO; SOT-23-5	Verify C19/C20 effective capacitance,stability and thermal load
U7	1	2.5 V precision voltage reference	LTC6655BHMS8-2.5#PBF LTC6655BHMS8-2.5#PBF; 2.5V reference; MSOP-8	Verify C22/C23,layout and measured reference voltage
U8	1	Low-input-bias operational amplifier	LMP7721 LMP7721; low-bias amplifier; SOIC-8; 1.8–5.5V	Confirm suffix,leakage/stability and output range
U9	1	16-bit SAR analog-to-digital converter	ADS8866IDGS ADS8866IDGS; 16-bit SAR, 100kSPS device limit; VSSOP-10	Verify sampling timing,input settling,decoupling and measured noise

Download the complete PCB CSV — Zenodo (publication pending)