INPUT 9–12 V: TVS, REVERSE-BLOCKING SWITCH (ACFET + RBFET), INPUT SENSE, AVCC FEED, OVP WINDOW

R6 10 mohm: input current limit 2.5 A (ACSET)
C6 10 uF 35 V X6S at PVCC / PGND (hot loop)

J1 VIN+ · J2 VIN− · D1 SMF15A · C2 1u 25V · VIN · GND

Q1 CSD17313Q2 · Q2 CSD17313Q2 · QS · QG · ACP

C1 47n · R2 4.02k · R1 4.02k · C5 100n · R6 10m (NT1, NT2) · C4 100n · PVCC · ACN_S · ACP_S

PWR_FLAG · C6 10u 35V

C1: slows the ACFET turn-on (inrush into PVCC)

D2 RB521S30 · AVIN · R3 10 · R4 100k · R5 13.7k

D2: reverse protection of AVCC / OVPSET
OVPSET window: 4.4 V < VIN < 13.6 V

U1 BQ24170 (ACMSRC, ACDRV, ACP, ACN, AVCC, SW, BTST, SRP, SRN, REGN, OVPSET, AGND, PGND, VREF, ISET, ACSET, TS, ITC, STAT, BATDRV, CELL)

C3 1u 25V · C8 47n · C9 1u 25V · C12 100n

AGND (exposed pad) and PGND meet only under the IC

OUTPUT: L, SENSE, BATTERY PADS

L1 3.3 uH + C13 / C14 (about 18 uF at 8.4 V): 20.6 kHz (TI: 15–25 kHz)
R7 20 mohm: ICHG = V(ISET) / (20 x R7)

L1 3.3u · R7 20m (NT3, NT4) · C11 100n · C13 22u · C14 22u · VBAT · SW · SRP · SRN · BM

J3 B+ · J4 BM · J5 B−

CELL open = 2 cells, 8.40 V
BATDRV unused (no system load)

Battery 2S1P on the bottom-side pads:
B+ / B− carry 2 A (20–22 AWG), BM = balance tap

CELL BALANCING (10 mA) AND 4.30 V PER-CELL STOP

R19 100 · PWR_FLAG · VBAT · C16 100n · BAL_VDD · GND

U2 BQ29209 (VDD, OUT, VC2, VC1, VC1_CB, CB_EN, CD, GND)

R16 162 · C17 100n · R17 261 · R18 100 · BM · C18 100n · C19 330n 16V

C19: 3 s OVP delay

R20 1M · Q3 DMG1012T · BAL_VDD · VREF

TI SLUSA52C Figure 9: RCB 100 / 261 / 162 ohm, RVD 100 ohm:
10 mA balancing from 30 mV imbalance down to 0 mV

Q3: balancing only with the adapter
(VREF is off in SLEEP)

CHG_OFF

SETTINGS: CHARGE CURRENT (R9), INPUT LIMIT, BATTERY NTC, SAFETY TIMER, STATUS LED

VREF · C10 1u 25V

ISET · R8 100k · R9 31.6k

R9 sets the charge current:
31.6 k 2.0 A, 22.1 k 1.5 A,
13.7 k 1.0 A, 6.49 k 0.5 A

VREF · R10 100k · R11 17.8k

2.5 A input limit

25 x 16 mm board, 1.4 W at 2 A: in still air U1 (thermal loop at TJ 120 C)
sits at the fold-back threshold at 2 A: 2 A needs >= 0.5 m/s of air
(R9 = 22.1 k: 1.5 A for still air).
All ceramics X6S / X7R (105 / 125 C).

J6 NTC · J7 NTC GND · R14 10k (DNP) · R12 5.1k · R13 30.1k · TS

External 10 k NTC on the pack (103AT, B3435: 2–45 C;
B3950: 4–43 C). No NTC = no charge (TS reads cold);
R14 fitted = no temperature check

VREF · R15 1.5k · D3 red · STAT · C15 33n

33 nF: 3.1 h fast-charge timer

D3 on: charging; off: done / no adapter;
blinking: fault (timer, NTC, battery absent, input OV)

ISET · CHG_OFF · Q4 DMG1012T · R21 1M

Q4: charge off while a cell is above 4.30 V
(BQ29209 OUT: R21 keeps it off without a pack)

VIN · VBAT · PWR_FLAG · GND

4 layers, parts on top, wire pads on the bottom
BQ29209 cell balancing (10 mA, on with the adapter) and 4.30 V per-cell stop
BQ24170 1.6 MHz buck charger, 8.40 V, 2 A set by R9, 3.1 h timer

Sheet: /		
File: 2s_charger.kicad_sch		
Title: 2S Li-ion charger 2 A with cell balancing (9–12 V in)		
Size: A3	Date: 2026-11-02	**Rev: 1**
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