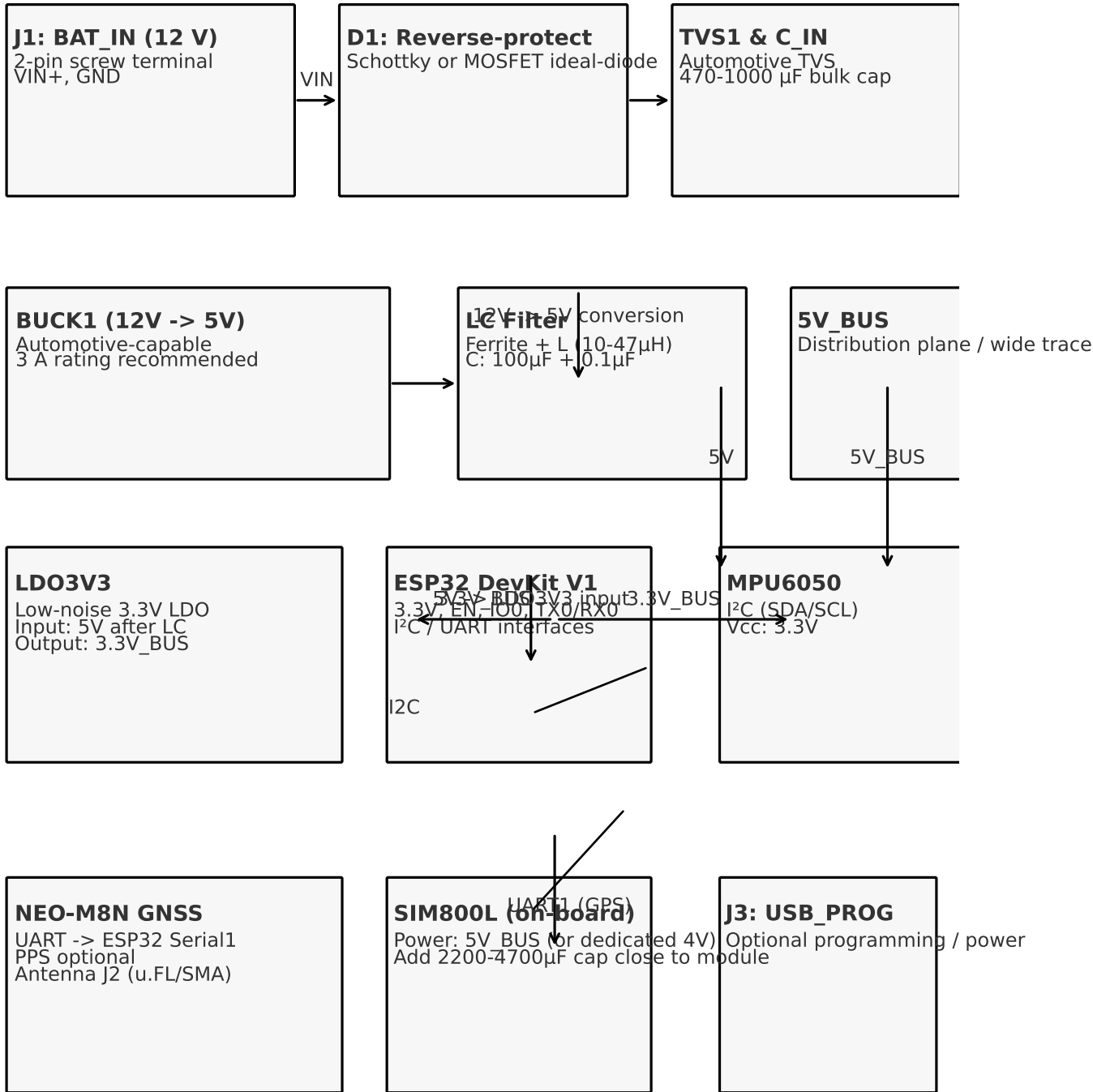


Bike Safety System — Schematic (Block-level)



Notes:

- TP4056 battery charger module shown as EXTERNAL (on-board optional).
- SIM800L requires large local reservoir capacitors (2200-4700 μ F).
- GNSS antenna must be kept away from switching elements (≥ 30 mm).
- Add TVS + reverse-protection on 12V input for automotive transients.
- Decouple each IC with 0.1 μ F MLCC + 1-10 μ F MLCC + 10-470 μ F bulk caps as needed.

Bike Safety System – Detailed Schematic Notes, Netlist & BOM

Power Nets:

- VIN (12V) -> D1 (reverse-protect) -> TVS1 -> C_IN -> BUCK1 -> 5V_BUS
- 5V_BUS -> LC Filter -> LD03V3 -> 3.3V_BUS (ESP32, MPU6050, NEO-M8N)
- SIM800L connected to 5V_BUS (recommended dedicated filter + 2200-4700uF cap)
- TP4056 (battery charger) is EXTERNAL in this schematic but shown in BOM

Connectivity:

- ESP32 DevKit V1
 - * 3.3V -> VCC
 - * GND -> GND
 - * I2C -> MPU6050 (SDA,SCL) with 2.2k pull-ups to 3.3V
 - * UART1 (TX1/RX1) -> SIM800L
 - * UART2 (TX2/RX2) -> NEO-M8N
- MPU6050: VCC 3.3V, SDA, SCL, INT (optional)
- NEO-M8N: VCC 3.3V, UART TX/RX, PPS (optional), ANT (u.FL/SMA)
- SIM800L: VCC (5V_BUS or dedicated 4V), TX/RX to ESP32 UART1, GND, ANT

Suggested BOM (summary):

J1 - 2-pin screw terminal, 5.08mm
D1 - Schottky diode or ideal-diode MOSFET (reverse-protection)
TVS1 - Automotive TVS (load-dump rated)
C_IN - 470uF@25V low-ESR
BUCK1 - 5V 3A automotive buck converter (board-mount or module)
L1 - 10-47uH inductor for LC filter
F1 - Ferrite bead (1206/0805)
C_OUT - 220uF@10V low-ESR
LD03V3 - Low-noise 3.3V LDO (TLV70033 style)
U1 - ESP32 DevKit V1 module (WROOM)
U2 - MPU6050 IMU breakout
U3 - NEO-M8N GNSS breakout
U4 - SIM800L GSM module (optional onboard)
TP4056 - External battery charger module (if using Li-ion)
Misc - resistors, LEDs, NPN transistor for buzzer, polyfuse, footprints