**Bill of Materials**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Modules | Label or  Nickname | Product  Name or Code | Detailed  Description | Unit  Cost | Quantity | Function | Socket |
| 1 | Arduino Beetle Board | DFRobot0282 | ATmega32U4 Beetle AVR® ATmega AVR MCU 8-Bit Embedded Evaluation Board | R 194.64 | 4 | BMS monitoring module MCU. | J1, J2, J3, J4  1x7pin, 1x5pin, 1x5pin, 1x7pin |
| 2 | TPS61023 5V Mini-Booster | 4654 | The TPS61023 is a thermally efficient chip that integrates dual 3A MOSFET switches. This mini-booster operates at ±2.5% reference voltage accuracy over -40°C to +125°C temperature range. | R 69.34 | 4 | 5V system supply. | J8, 1x4pin |
| 3 | 16-bit ADC | ADS1110 Module | ADS1110 High Precision A/D Converter, 16-Bit, I2C, Low Power | R 88.00 | 4 | High resolution cell voltage measurement. | J27, 1x6pin |
| 4 | External Temp sensor | 18B20 Temperature Module | Electronic thermometer which has high accuracy over a wide range (accurate to ±0.5°Cover the range of -10°C to +85°C). | R22.00 | 4 | Cell temperature measurement | J16, 1x3pin |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| PCB compo-nents | Tag | Product  Name or Code | Detailed  Description | Unit  Cost | Qnty | Function | KiCad | | | |
| Ref | Qnty | Val | Dscrp |
| 1 | 0.1µF Capacitor | C1608X7R1E104K080AA | 0.1 µF ±10% 25V Ceramic Capacitor X7R 0603 (1608 Metric) | R0,51 | 8 | Filter comms isolated supplies. | C1, C2 | 2 | 0.1µF | Unpolarized capacitor |
| 2 | Red LED | LTST-C150KRKT | Red 631nm LED Indication - Discrete 2V 1206 (3216 Metric) | R3,45 | 5 | System debug indicator. | D1 | 1 | 20mA 2V LED | Light emitting diode |
| 3 | Green LED | LTST-C150KGKT | Green 470nm LED Indication - Discrete 3.3V 1206 (3216 Metric) | R3,45 | 4 | Indicate module power on. | D2 | 1 | 20mA 2V LED | Light emitting diode |
| 4 | Blue LED | LTST-C150TBKT | Blue 470nm LED Indication - Discrete 3.3V 1206 (3216 Metric) | R3,45 | 4 | Indicate when dumpload is active. | D3 | 1 | 20mA 2.8V LED | Light emitting diode |
| 5 | Fuse | 021701.6TXP | FUSE GLASS 1.6A 250VAC 5X20MM | R6,49 | 4 | Overcurrent protection. | F1 | 1 | Fuse 1.6A. | Glass fuse |
| 6 | NMOS | IRF540NLPBF | N-Channel 100 V 33A (Tc) 130W (Tc) Through Hole TO-262 | R20,35 | 8 | High-side switch. | Q1, Q2 | 2 | IRF540N | 33A Id, 100V Vds, HEXFET N-Channel MOSFET |
| 7 | Comms isoChip | ISO7421D | General Purpose Digital Isolator 2500Vrms 2 Channel 1Mbps 25kV/µs CMTI 8-SOIC (0.154", 3.90mm Width) | R54,34 | 4 | Isolates module different voltage levels on comms line. | U1 | 1 | ISO7421 | 25kV isolating voltage coupler |
| 8 | 2channel ANDgate | SN74LVC2G08DCTR | Texas Instruments SN74LVC2G08DCTR, Dual 2-Input AND Logic Gate, 8-Pin SSOP | R13,94 | 4 | Communication logic hardware. | U2 | 1 | SN74LVC2G08DCTR | Dual channel and gate |
| 9 | LM4040AIM2 Vref IC | Texas Instruments Fixed Shunt Voltage Reference 2V ±0.1 % 3-Pin SOT-23, LM4040AIM3-2.0/NOPB | Precision Fixed and Adjustable Voltage Reference ICs utilising series, shunt or series/shunt topologies and available in both through-hole and surface mount packages. Voltage References are available with initial accuracies of ±0.02 to ±2%. | R58,64 | 4 | Provide high precision reference voltage for ADC module. | U3 | 1 | LM4040DBZ | 2.000V Precision Micropower Shunt Voltage Reference |
| 10 | Thermistor | TE Connectivity Thermistor, 10kΩ Resistance, NTC Type, 0805 (2012M), 2 x 1.25 x 0.5mm | NTC chip thermistors offering a high thermal sensitivity. Suitable for temperature compensating circuits and other applications requiring a resistance that varies according to the ambient temperature | R23,79 | 4 | Used to measure the module’s internal temperature. | TH1 | 1 | Thermistor\_NTC | Temperature dependent resistor, negative temperature coefficient |
| 11 | 150Ω Resistor | CRGP1206F150R | 150 Ohms ±1% 0.5W, 1/2W Chip Resistor 1206 (3216 Metric) Pulse Withstanding Thick Film | R4,99 | 8 | Limit current to LED. | R1, R5 | 2 | 150Ω | Chip resistor |
| 12 | 10kΩ Resistor | RNCP1206FTD10K0 | 10 kOhms ±1% 0.5W, 1/2W Chip Resistor 1206 (3216 Metric) Anti-Sulfur Thin Film | R1,56 | 16 | Pull up, pull down resistors. | R2, R4, R7, R13 | 4 | 10kΩ | Chip resistor |
| 13 | 499Ω Resistor | ERA8AEB4990V | Panasonic 499Ω, 1206 (3216M) Thin Film SMD Resistor ±0.1% 0.25W | R9.18 | 8 | Limit mosfet’s gate current. | R3, R6 | 2 | 499Ω | Chip resistor |
| 14 | 20Ω Resistor | CRCW120620R0FKEAHP | Vishay 20Ω, 1206 (3216M) Thick Film SMD Resistor ±1% 0.5W | R5,12 | 4 | Limit current to LED. | R8 | 1 | 20Ω | Chip resistor |
| 15 | 13Ω Resistor | HRG3216Q-13R0-D-T1 | 13 Ohms ±0.5% 1W Chip Resistor 1206 (3216 Metric) Anti-Sulfur, Automotive AEC-Q200, Moisture Resistant Thin Film | R9,74 | 16 | Dumpload resistors. | R9, R10, R11, R12 | 4 | 13Ω | Chip resistor |
| 16 | 1kΩ Resistor | CRCW12061K00FKEA | Vishay 1kΩ, 1206 (3216M) Thick Film SMD Resistor ±1% 0.25W | R1,52 | 4 | Pull-down | R14 | 1 | 1kΩ | Chip resistor |
| 17 | 2.2kΩ Resistor | ERA8AEB222V | Panasonic 2.2kΩ, 1206 (3216M) Metal Film SMD Resistor ±0.1% 0.25W | R8,36 | 8 | ADC pull-up resistors. | R15, R16 | 2 | 2.2kΩ | Chip resistor |
| 18 | 1µF Capacitor | C1608X7R1E105K080AB | 1 µF ±10% 25V Ceramic Capacitor X7R 0603 (1608 Metric) | R1,41 | 4 | ADC supply filter. | C3 | 1 | 1µF | Filter capacitor |
| 19 | Terminal connectors | 360272 | Terminal Block MetzConnect 360272 1x1 Screw M2.6 | R8,88 | 8 | Connects module to cell terminals. | J5, J6 | 2 | Screw Terminal 1x1 | Generic screw terminal, single row |
| 20 | Current sensor. | Allegro Microsystems ACS770LCB-100U-PFF-T, Current Sensor IC 5-Pin, PFF | Allegro Current sensor IC, conductor resistance of 100 μΩ typical for ultra-low power loss, Hall Effect Current Sensor. | R157.61 | 1 | Measures the battery current at master controller. |  |  |  |  |
| 21 | 1 Channel AND gate | SN74LVC1G08DCKR | Texas Instruments 2-Input AND Logic Gate, 5-Pin SC-70 | R16.15 | 4 | Communication logic hardware. | U4 | 1 | 74LVC1G00 | Single channel and gate |