

Transfer Multisort Elektronik (TME) supports the development of high-reliability electronic architectures within the HYPED (Hyperloop Edinburgh) hyperloop pod. The electronics team is responsible for the design, validation, and integration of power distribution, sensing, and control systems that interface between software and electromechanical subsystems. This includes PCB design, converter development, signal conditioning, and safety-critical monitoring infrastructure supporting propulsion, levitation, traction, and auxiliary systems. The selection of robust, industrial-grade components is fundamental to ensuring electrical safety, thermal stability, and operational reliability under high-power conditions.

A key requirement within the pod's high-voltage architecture is reinforced galvanic isolation between low-voltage control electronics and high-energy power domains. Within the High Voltage Active Light (HVAL) and traction subsystems, the **LTV-354T optocoupler** is implemented to provide optical signal transmission across isolated boundaries. The device mitigates common-mode transients and prevents hazardous voltage propagation to logic-level circuitry by eliminating direct electrical conduction between control and power stages. This isolation strategy improves electromagnetic compatibility (EMC), enhances noise immunity in switching environments, and provides protection against fault conditions. Integration within custom high-voltage PCB layouts ensures compliance with insulation requirements, creepage and clearance constraints, and system-level safety objectives.

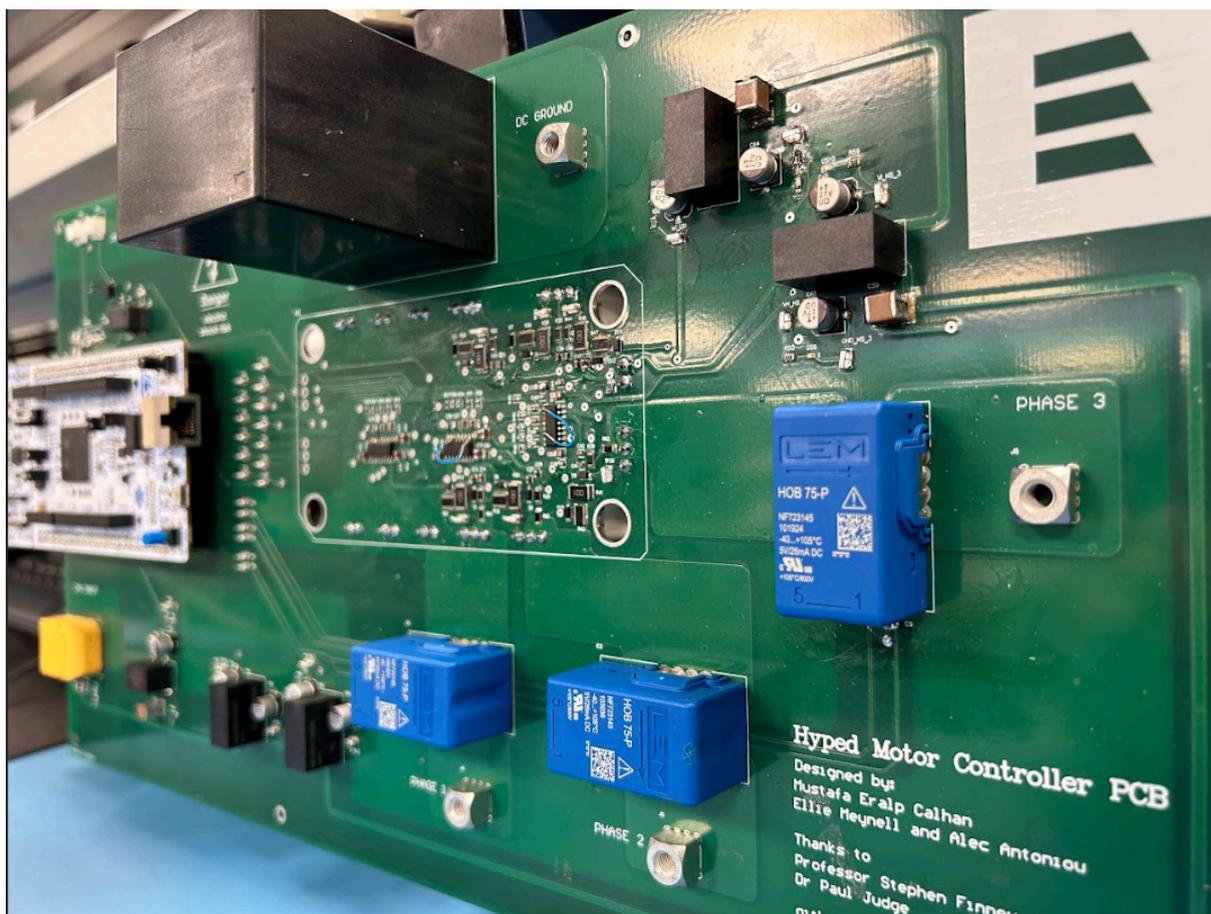


Figure 1: HYPED Custom PCB

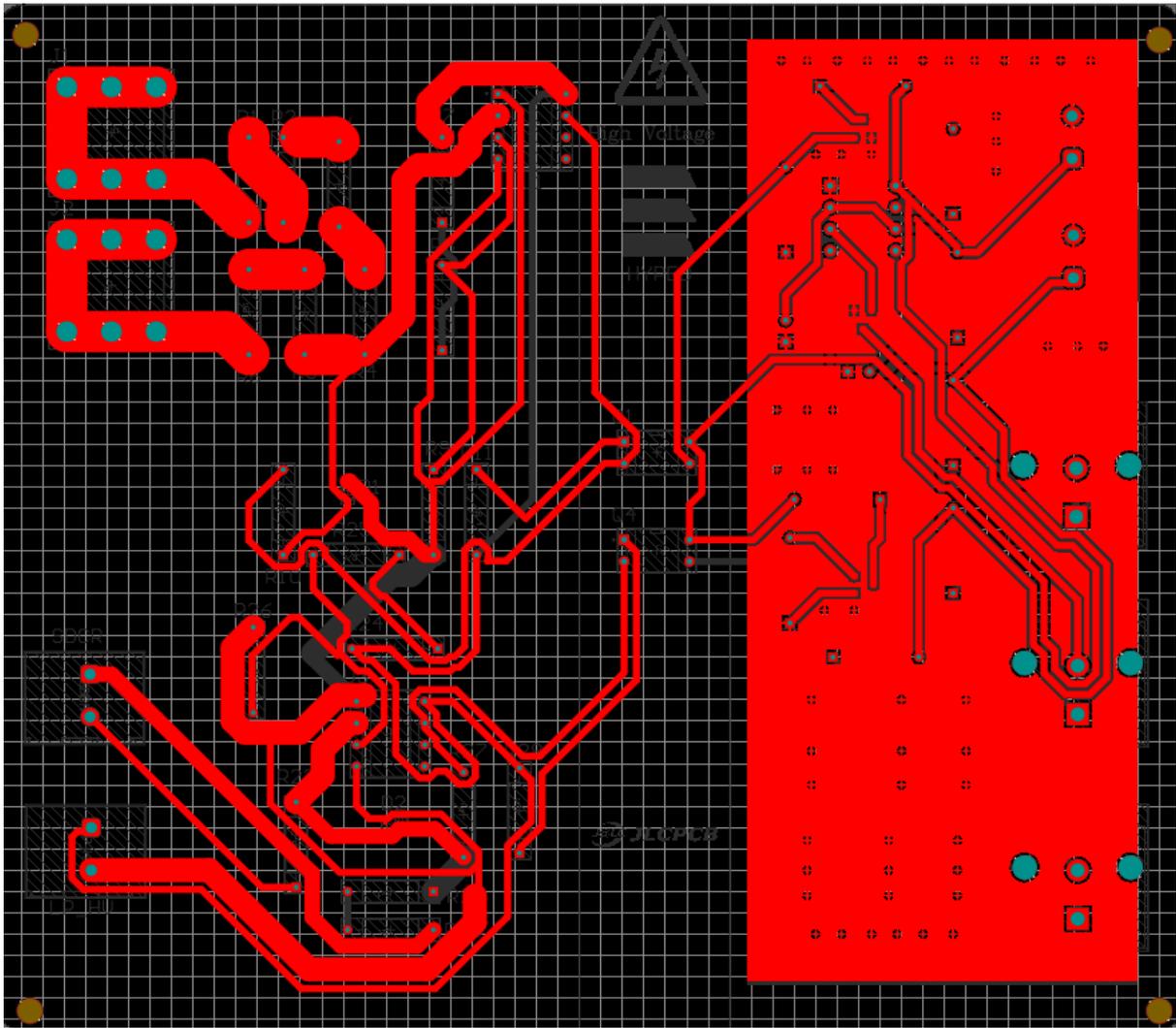


Figure 2: PCB Layout of the Active Light System

Thermal management represents a critical design constraint for high-power components, including the linear induction motor (LIM), power converters, and energy storage systems. To maintain components within specified thermal operating limits, the cooling architecture incorporates the **AK-FN120 DC fan** in conjunction with the **STO12 DC fan controller** for closed-loop airflow regulation. This configuration enables controlled forced convection, reducing junction temperatures and preventing thermal derating of power electronics. Active airflow control improves heat transfer efficiency, stabilises operating conditions during dynamic load variations, and increases long-term system reliability by minimising thermal stress and component degradation.

Mechanical protection, electromagnetic shielding, and thermal conduction are addressed through the use of the **1590J aluminium enclosure** for the low-power battery and battery management system. The enclosure provides a mechanically robust housing with high structural rigidity and impact resistance, while its conductive aluminium construction contributes to electromagnetic interference (EMI) attenuation and passive heat dissipation. The enclosure also supports modular integration, environmental protection, and secure mounting of sensitive electronic assemblies within the pod structure.



Figure 3: Aluminium Enclosure for Batteries and Battery Management System

Beyond hardware selection, the electronics team manages the complete system development lifecycle, including schematic capture, PCB layout optimisation, prototype validation, and hardware testing. In collaboration with propulsion, navigation, and traction teams, we implement real-time monitoring of motor temperature and phase current, develop surge protection and fail-safe communication mechanisms, and design high-current switching circuits for braking and levitation control. System architecture emphasises redundancy, fault tolerance, and deterministic communication protocols to ensure safe operation under fault conditions.

Through the integration of high-performance components and rigorous engineering practices, our collaboration with Transfer Multisort Elektronik enables the implementation of scalable, safety-critical electronic systems that support the performance and reliability requirements of next-generation Hyperloop transport.

Transfer Multisort Elektronik (n.d.-a) *LTV-354T optocoupler*. Available at:
<https://www.tme.eu/gb/details/ltv-354t/optocouplers-analog-output/liteon/>

Transfer Multisort Elektronik (n.d.-b) *STO12 DC fan controller*. Available at:
<https://www.tme.eu/gb/details/sto12/controllers/>

Transfer Multisort Elektronik (n.d.-c) *AK-FN120 DC12V fan*. Available at:
<https://www.tme.eu/gb/details/ak-fn120/dc12v-fans/akasa/>

Transfer Multisort Elektronik (n.d.-d) *1590J aluminium enclosure*. Available at:
<https://www.tme.eu/gb/details/hm-1590j/multipurpose-enclosures/hammond/1590j/>

