University of Waterloo

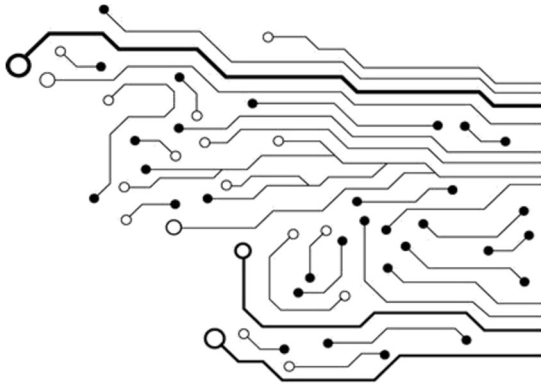
Co-operative Work Terms

Mark Khairallah
21120249
1B Electrical Engineering, Honours, Co-operative Program

Work Term	Employer	Evaluation
Jan - Apr 2025	Linamar Corporation Divisional Office Guelph Ontario Canada Electrical Engineering Co-op Student	OUTSTANDING

Planned Future Work Term(s)

Sep - Dec 2025
May - Aug 2026
Jan - Apr 2027
Jan - Apr 2028
Sep - Dec 2028



Mark Khairallah

Electrical Engineer

647.676.4599	Markkh06@gmail.com	Mississauga, Ontario

Dear Hiring Manager,

I'm an Electrical Engineering student at the University of Waterloo, applying for an engineering internship. I recently designed and assembled a 5V buck converter PCB using the AP62200, and this project became a hands-on crash course in power electronics and debugging.

After initial testing, I observed 5.4V overshoot and ~200 mV ripple during light-load transitions. I isolated the root causes to poor feedback trace routing, suboptimal capacitor placement, and insufficient output capacitance. By rerouting the feedback path to minimize noise pickup, placing bypass caps tighter to the IC, and increasing output cap values, I reduced overshoot to 5.05V and ripple to ~50 mV. I verified these improvements using an oscilloscope and signal generator, analyzing startup behavior, transient response, and steady-state performance.

This project gave me experience in switching regulator design, PCB layout strategy, and real-world signal integrity—skills I'd love to bring to your team.

Thank you for considering my application. I look forward to the opportunity to contribute meaningfully to your team and grow as an engineer.

Sincerely,
Mark Khairallah

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Mark Khairallah

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linkedin.com/in/mark-khairallah

Summary of Qualifications

Hands-on electrical engineering student with a track record of building tested, functional systems—from PCBs to embedded logic.

Skilled in PCB design, debugging, and embedded development, demonstrated through solar EV sensing systems and test automation projects.

Proficient in **VHDL, FSMs, and datapath design**, with FPGA-based projects showcasing functional correctness and timing analysis.

4 years of experience in **Python and C/C++**, focused on low-level programming, hardware interfacing, and automation.

Work Experience

Skyjack Inc. — Electrical Engineer Co-op Jan 2025 – May 2025

- Created schematics for lift machines involving **digital logic, sensor inputs**, and relay control systems.
- Built and wired a second Automated Test Bench with **custom I/O maps and truth tables**, increasing throughput by **100%**.
- Used **oscilloscopes, signal generators**, and multimeters to validate state transitions and debug logic faults.
- Programmed **CANdb networks** to integrate logic outputs with system-level diagnostics.

Midnight Sun Solar Car Team — Hardware Designer Sep 2024 – Present

- Developed multilayer PCBs in **Altium Designer** for high-voltage monitoring and solar array diagnostics.
- Designed a voltage sense board to scale and isolate **150V signals** using passive dividers and differential inputs.
- Improved power system safety via **voltage threshold detection** and fault-resistant routing.
- Participated in peer reviews, build milestones, and validation phases with **tight design deadlines**.

Personal Projects

High-Efficiency Buck Converter PCB

- Achieved **95% efficiency at 1A load** by optimizing switch node layout, feedback trace routing, and output capacitor selection.
- Validated functionality with **oscilloscope + multimeter** under varying load; resolved 5.4V overshoot via output cap tuning.
- Demonstrated complete workflow from schematic to bring-up and EMI-aware layout in **Altium Designer**.

4-bit FPGA ALU with RTL Simulation

- Engineered a modular, control-separated ALU with **MUX-driven datapath** and active-low IO.
- Tested ALU on FPGA at 50 MHz; verified stability of carry propagation under timing constraints.
- Built a clocked 7-segment MUX for dynamic display, aiding real-time debugging on physical board.

Education & Awards

University of Waterloo — BASc, Electrical Engineering Waterloo, ON

- **John Hamel Memorial Scholarship** – awarded to Most Outstanding first-year Electrical Engineering student.

Skills

- **Languages:** C/C++ (4 yrs), Python (4 yrs), Java (3 yrs), VHDL (RTL), MATLAB
- **Hardware:** Altium Designer, schematic capture, PCB layout, signal probing, oscilloscope, multimeter
- **Digital Design:** FSMs, datapaths, ALUs, logic gates, flip-flops, timing analysis, clock domain crossing
- **Embedded Systems:** STM32, Arduino, I2C, SPI, UART, real-time control, bring-up, hardware debugging
- **Tools:** Git, STM32CubeIDE, VS Code, SolidWorks, Microsoft Office

UNIVERSITY OF WATERLOO
UNOFFICIAL GRADE REPORT

Mark Khairallah
21120249

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Fall 2025

PD	20		Strategies for Career Success	
Term Average:		N/A	Decision:	

Spring 2025

GENE	120		First-Year Eng Seminar	
ECE	124		Digital Circuits & Systems	
ECE	102		Information Session	
ECE	192		Eng Economics & Society Impact	
ECE	140		Linear Circuits	
MATH	119		Calculus 2 (Eng)	
ECE	108		Discrete Math & Logic 1	
ECE	106		Electricity & Magnetism	
Term Average:		N/A	Decision:	

Winter 2025

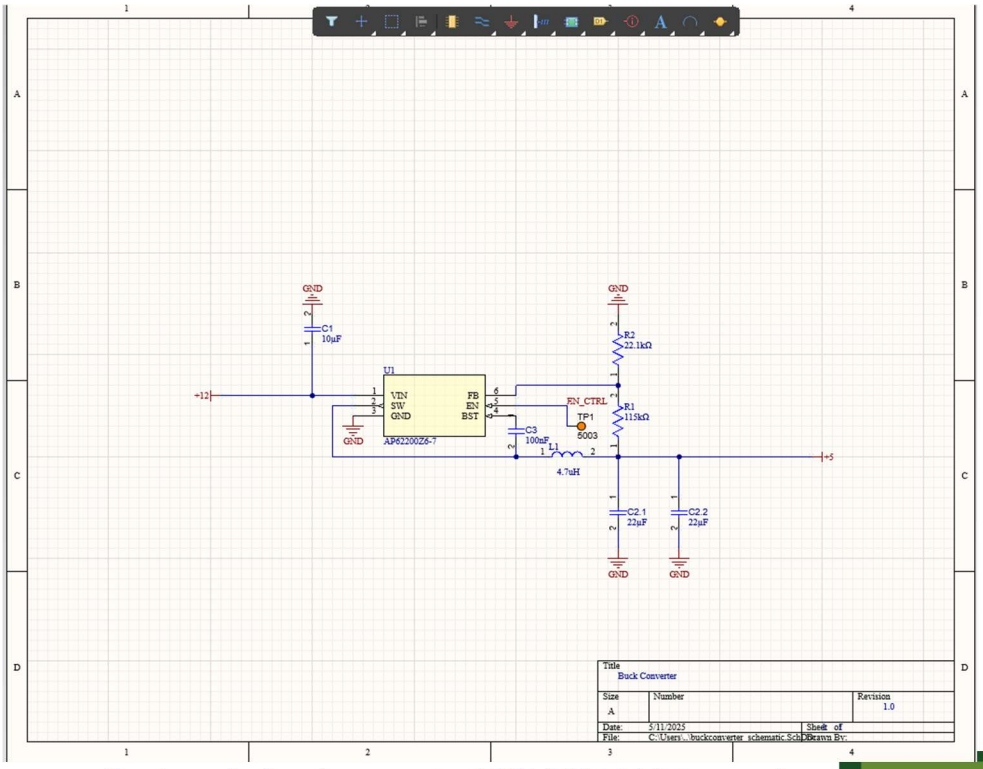
PD	19		Tactics for Workplace Success	CR
COOP	1		Co-operative Work Term	CR
Term Average:		N/A	Decision:	

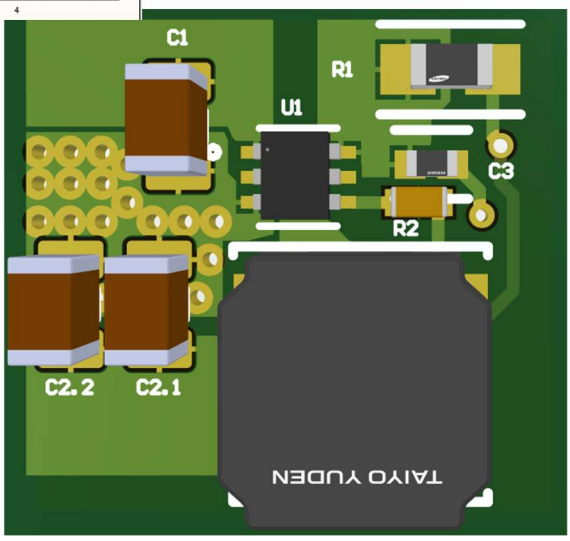
Fall 2024

ECE	150		Fundamentals of Programming	79
ECE	198		Project Studio	73
GENE	119		First-Year Engineering Seminar	
MATH	117		Calculus 1 (Eng)	82
ECE	190		Eng Profession & Practice	82
MATH	115		Linear Algebra (Eng)	87
ECE	105		Classical Mechanics	77
COMMST	192		Eng Comm (COMPE/ELE/MGTE)	87
Term Average:		81.58	Decision:	Excellent Standing

Mark Khairallah – Portfolio

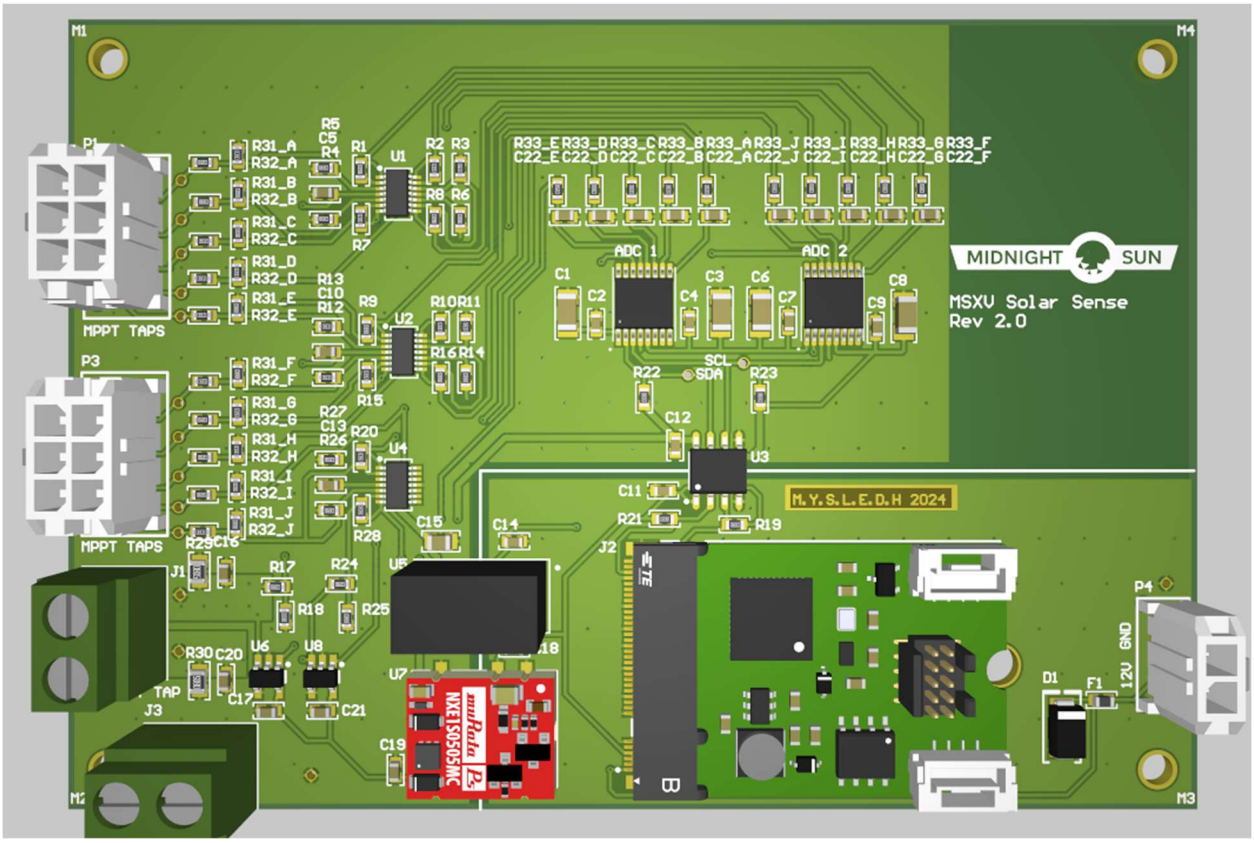
Buck Converter PCB





- Designed a buck converter PCB (9V → 5V) to supply regulated power to microcontrollers and logic devices in embedded systems.
- Used Altium Designer for schematic capture and PCB layout, applying EMI-reduction strategies and optimal trace routing.
- Calculated duty cycle and MOSFET on-times using PWM control equations, optimizing switching efficiency for continuous conduction mode.
- Analyzed PFM operation using datasheet graphs to understand low-load behavior and ensure stable mode transitions.
- Selected and sized inductors, capacitors, and diode to meet current ripple, thermal, and load response specifications.

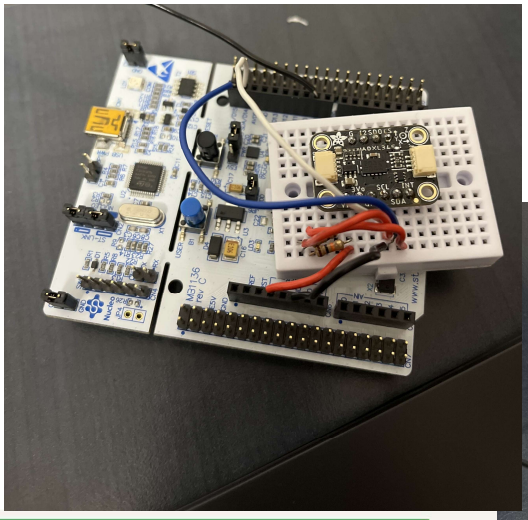
Solar Sense PCB

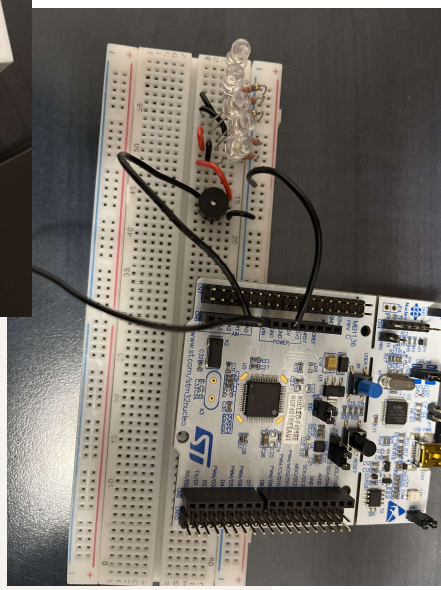


- Designed a 2-layer Solar Sense PCB to capture voltage drops across solar arrays, enabling IV curve characterization for the Midnight Sun solar car.
- Integrated a SOT23-5 current sense amplifier and routed outputs to an external 12-bit sigma-delta ADC for high-resolution analog measurements.
- Selected and implemented a 16-TSSOP, 8-channel ADC to digitize multiple voltage and current signals with improved accuracy and noise tolerance.
- Optimized analog routing and component placement to reduce interference and maximize signal fidelity across the solar array monitoring system.
- Worked with firmware and systems teams to ensure seamless communication between the ADC and central processing unit, supporting real-time telemetry.

Fall Detector Project

- Built a fall detection system using an STM32 microcontroller and a self-soldered ADXL345 accelerometer as part of a term project for ECE198: Project Studio at the University of Waterloo.
- Programmed in C++ using STM32CubeIDE, configuring I^2C communication with the ADXL345 and developing logic to detect free-fall and impact conditions and to alert those nearby with audio (buzzer) and visual (LED) alerts.
- Applied digital signal processing techniques to smooth acceleration data and implemented a real-time algorithm to distinguish between falls and normal movement.
- Created a complete engineering design report, documenting system architecture, schematics, software flow, and test methodology.
- Collaborated in a team to produce detailed technical documentation, schematics in KiCad and deliver a final project presentation, demonstrating both hardware and software functionality.





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This job is funded by the Government of Canada as advertised in the job posting. To be eligible you must be a Canadian citizen, permanent resident or a protected person defined by the Immigration and Refugee Protection Act. Do you meet this requirement?	Yes
Are you open to an 8 months co-op?	Yes