

# Condition monitoring Circuit for Semiconductor Switching Devices

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## Objective/Background

- Design and implement a condition monitoring system for SiC MOSFETs using a current mirror circuit to detect gate-source leakage current in real-time.
- Implement a Synchronous Buck Converter for Controlled Testing
- Integration of ESP32 Microcontroller for Signal Processing
- Testing and Characterization of Gate-Source Leakage Response
- Implementation of a Feedback Control System

## Methodology

Developing a circuit designed to monitor the condition of semiconductor switching devices, particularly focusing on silicon carbide (SiC) MOSFETs.

This circuit includes a bypass circuit, a current mirror, and a synchronous buck converter to measure the gate-source leakage current  $I_{gss}$  to identify potential failures or issues within the device as early as possible.

## Results/Application

Based on the proposed circuit, I designed a printed circuit board (PCB). It can be used to detect gate leakage currents.

A voltage sensor can detect the gate leakage of the SiC MOSFET. Sensing Voltage  $V_s$  is nearly independent of the duty cycle and changes with  $R_{gss}$  corresponding to  $I_{gss}$ . Guess can be estimated using the source voltage level  $V_s$  and the current mirror configuration.

