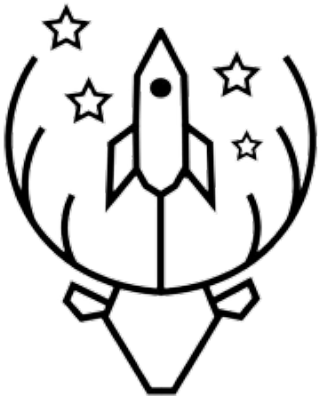
Peryton Space StagWorks



PERYTON SPACE

UNIVERSITY OF SURREY

Remove Before Flight

Test Review Document

V 1.0

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Introduction

This document aims to serve as a record of the Peryton team's journey in working towards developing cutting-edge rocket and satellite technologies. It captures the experiments conducted, successes celebrated, and challenges faced along the way which provide useful lessons and area for improvement.

The paper is structured to detail the project work that has been undertaken, (involving the different aspects of the project), to showcase the initial concepts, and how this unfolded in the development phase of the project.

So, whether you are a member of our team, a future collaborator, or an enthusiast that is interested in Peryton's work, we hope that this document offers you valuable insights into the team at Peryton Space, where we continue to figure things out as we progress with this project.

Mission Statement

The goal of our project is to create a reliable method for arming rocket flight computers with a mechanism which once removed, will power and enable arming of rocket avionics.

The design will be subject to vibrations and shocks and high g-forces therefore the design must be a solid-state design with no moving parts that could activate during flight.

Milestones

The main aim of the testing phase is to have a working prototype circuit that can power on when a physical component is removed from the circuit.

Produced Work

The Texas instruments TPS22810 is a single channel load switch containing an N-channel MOSFET that can operate with an input voltage between 2.7 V to 18 V. The TS22810 chip is controlled by the state of the EN pin.

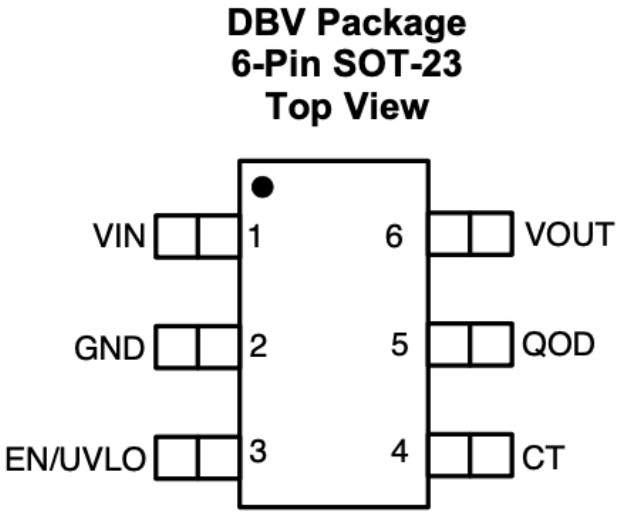

Figure 1 shows the pinout and footprint of the TPS22810 IC

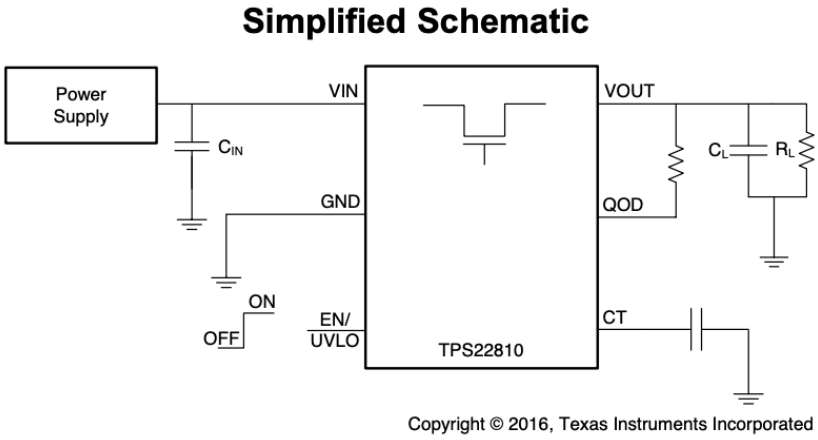

Figure 2 shows an applied circuit for the TPS22810

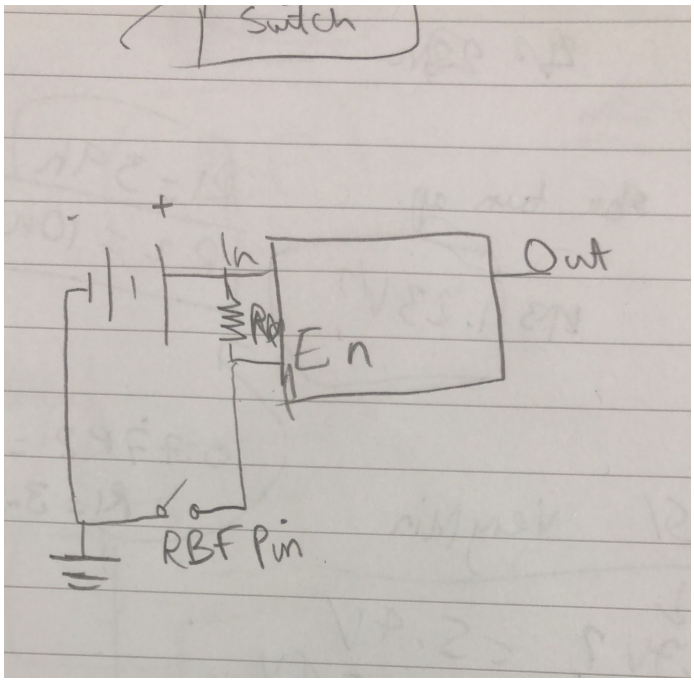

Figure 3 rough schematic by Mae Parsons

Based upon figure 2, the circuit in figure 3 was design for the use case of a “Remove Before Flight” application.

The pin EN is active-high, meaning it is powered on when is HIGH (Not 0v). When EN is HIGH the IC allows the power to pass through. But when EN is pulled LOW (To Ground) the circuity is switched off and the power doesn’t pass through. By pulling EN HIGH through a resistor, this stops the EN pin always going to ground or be floating (not connected to anything and left ‘floating’).

Utilising a “Remove Before Flight” pin, this physically completes a circuit bringing EN to ground. However, EN is connected to Vin via the pull resistor, so a suitable resistance is required to firstly allow the state of EN to go to the ground but to also reduce the risk of shorting the battery in the circuit.

As the EN pin will be pulled high upon adding power, it is important that when being used in real applications, the remove before flight pin is attached before powering on the circuit.

This circuit was implemented on a breadboard, (see figure 4), with an LED connected to Vout to visualise when it is activated.

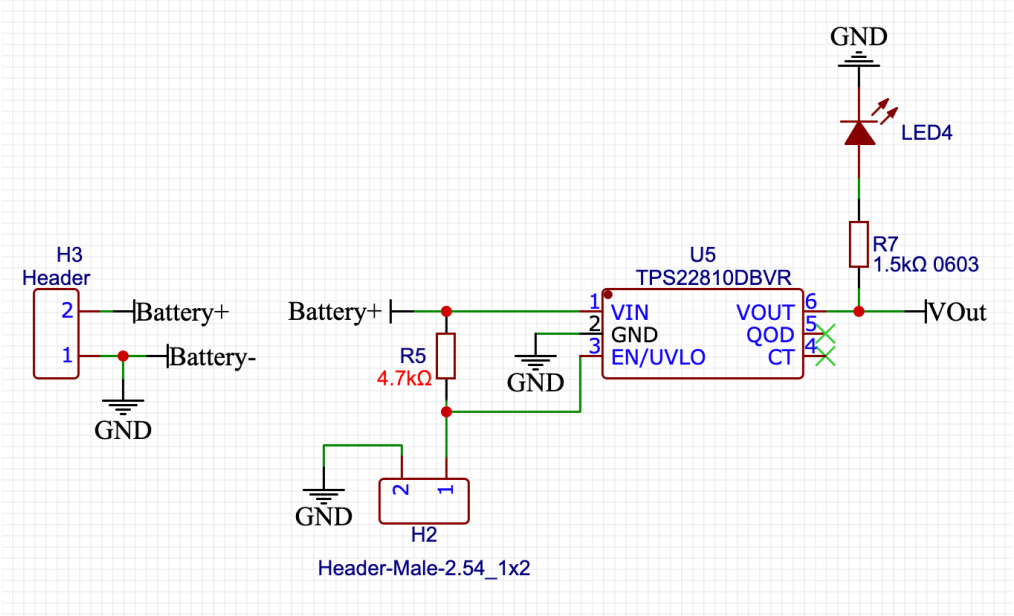

Figure 4 shows an implementation of the previous rough sketch

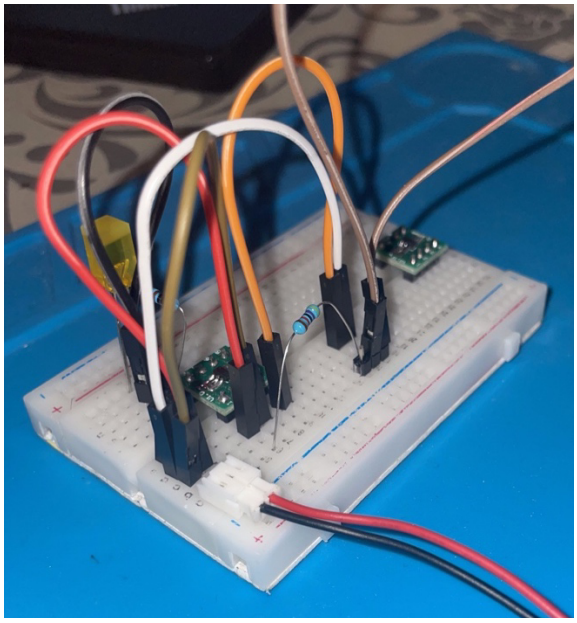

Figure 5 shows EN connected to ground

Figure 5 shows when EN is pulled low by adding the “Remove Before Flight pin (Brown Dupont wire) which turns off the output power and hence the LED is off.

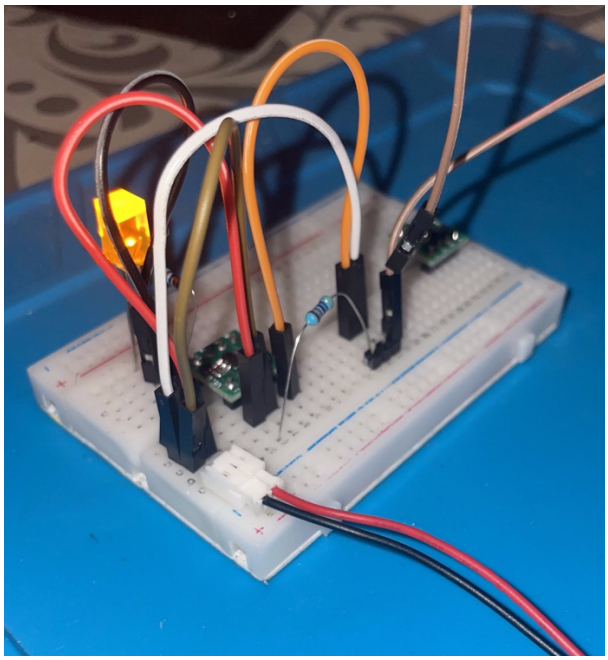

Figure 6 shows EN pulled high

Figure 6 shows when EN is pulled low by adding the “Remove Before Flight pin, (brown Dupont wire), which turns off the output power and hence the LED is off.

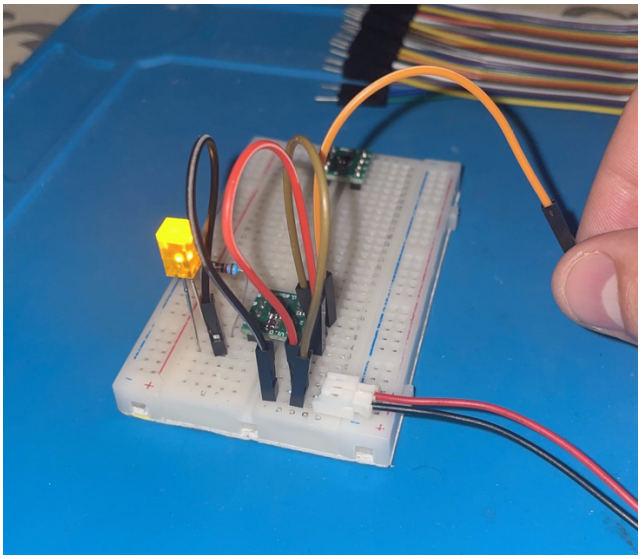

Figure 7 effect of floating EN

Figure 7 shows that when EN is not fully connected to VCC or GND, its response is unpredictable. Crucially, something which is seen away from the photo is the LED jittering with no contact due to the state of the pin floating, (not being connected to either). What the image does highlight is that simply touching the EN pin, any contact with it is enough to trigger it. This could be a risk when placed in real world applications as only such a small voltage applied causes activation.

Next Steps

The next steps of the project are to convert the current rough breadboard circuit into a PCB design with a more permanent physical removable switch, similar to one expected for its final application in a rocket.

The possibility of adding a delay from when the physical pin is removed would be a useful area to research and apply as it improves the safety of the design, which is vital for the expected real-life uses and applications.

Plan

In order to achieve these goals, we plan to create a PCB which has the expected physical hardware that would be required for effective use in real world applications. Also, we aim to ease the use and connectivity by adding screw terminals for power input as well as indicator LEDs for input and output power.