Buck Testing

# Unpowered Tests

* 10K on EN pins is actually 8.7k – IDK, don’t trust this multimeter

# Performance Tests

## Line Regulation

Line regulation is the ability of a power supply to maintain and constant output voltage, despite changes in the input voltage.

Note: should probably use a more accurate/sensitive voltmeter for this test since line regulation is expected to be <0.1%.

|  |  |
| --- | --- |
| **Vi** | **Vo** |
| 25 | 0 |
| 30 | 23.76 |
| 32 | 23.75 |
| 34 | 23.75 |
| 36 | 23.75 |
| 38 | 23.75 |
| 40 | 23.76 |
| 42 | 23.76 |
| 44 | 23.76 |
| 46 | 23.76 |
| 48 | 23.76 |
| 50 | 23.78 |
| 52 | 23.82 |

Given that the actual operating voltage is 40.8 – 50.2V, the line regulation across that interval would be,

d

## Load Regulation

Load regulation is the capability to maintain a constant voltage level at the output despite changes in the supply’s load.

Where,

* Vmin-load is the voltage when the output is open circuit
* Vmax-load is the maximum expected/allowable load
* Vnom-load is the voltage at a typical or specified load

## Efficiency

Efficiency is who effectively the buck steps down the voltage, how much power is lost.

Considerations for multiphase:

* PCB impedances cause voltage drops along the output trace of each phase as it routes from the switching node pins of the IC to the load
* A good, symmetric layout will minimize this impact. Layout asymmetries, however, can lead to imbalances in the outputs of the buck
* In order to properly calculate the efficiency of a multiphase buck, need to measure the current and voltage output at each phase individually.

## Output Ripple

Output ripple is the variation in voltage at the output caused by the switching nature of the regulator.

Can measure it peak to peak.

Can reduce output ripple by adding:

* More output capacitance
* LC filters
* Common Mode Chokes

## Transient Response

Load transient response is the response characteristic to a sudden load fluctuation, that is, the time until the output voltage returns to a pre-set value after having fallen or risen, and the waveform of the output voltage.

Measuring the transient response requires applying or removing a load suddenly and observing the effect on the output voltage.

Transient equation:

Based on this equation, the transient response can be improved by either increasing the output capacitance or increasing the switching frequency. Increasing the crossover frequency can also improve transient response.

## Measuring Significant Waveforms

Once we get some shots of each of the waveforms, can delve into what they should look like etc.

### SW1:

### SW2:

### HS1:

### HS2:

### LS1:

### LS2:

### FB1:

### FB2:

## Output Overcurrent Protection

Current limit is set to 15A per channel. To test this would need to apply a load of greater than 15A and see if it limits it and doesn’t explode. There are also two different current limit settings which are programmed via R18. The current limiting performance in each case should be compared.

### Latch off Current Limit

### Foldback Current Limit

## Output Overvoltage Protection

From datasheet: The output overvoltage-protection circuit protects the load under output overvoltage conditions. If the output voltage rises by more than 10% of its nominal value, the high-side MOSFET is turned off until the overvoltage condition clears.

If PWM mode is selected, the low-side MOSFET remains on until the output overvoltage condition clears. In this case, the current through the low-side MOSFET can reach a large value depending on the amount of overvoltage and output capacitance. If DCM is selected, the low-side MOSFET is turned off whenever the inductor current reaches zero. In this mode, the low-side MOSFET is turned on every 10 clock cycles to refresh the BST\_ capacitor.

* How to test load regulation and efficiency?
* What is the operating voltage range for the battery?
* Does testing the output overvoltage protection just mean applying too much voltage to the buck and see what happens at the output?

# Changes so Far

* Switched RT to 32200 ohm
* Removed R186