RRPL Telemetry
Harris Ransom
12/5/22

Radio Transmitter Power Distribution Design

Design Goals:

For powering the radio, a power distribution system is required. This distribution system must be able to supply the various voltages required by the various systems in the transmitter. The input supply from the battery will be in the 5-9V range (most likely 9V), with the required output voltages listed below.

Output Voltages Required:

- 5V: Mixer
- 4V: RF Power Amp VDD1
- 3V3: RF Power Amp VA/Vparamp, Oscillator, Adder?
- -3V3: Adder

Power Distribution Method:

Since all of the components need to be turned on at the same time, only one signal from the control device is required. This signal will control a switching mechanism (i.e. N-Channel MOSFETs) that will supply power from the two power rails to the various components.

Required Components:

- N-Channel MOSFET
  - Option 1
  - Option 2
- Smoothing/Filtering Ceramic Capacitors (0.1uF, 0.33uF, 10uF, 22uF)
- 5V Linear Voltage Regulator
  - Option 1
  - Option 2
  - While a Linear Voltage Regulator like the MIC29310 is not the most power-efficient solution, it is a simple and effective way to manage the voltages we require.
- 4V Adjustable Voltage Regulator
  - Option 1
  - Resistors: R1=2.26KOhm, R2=1KOhm
    - $V_{out} = V_{ref}(1 + \frac{R_1}{R_2})$
    - $V_{out} = 4V$, $V_{ref} \approx 1.23V$

    - The RF Power Amp recommends a Vdd supply of 4V for typical operation, and this is what the various characteristic curves in the datasheet are based off of. While it would be feasible to connect the supply to either the 3.3V or 5V power rail (these are within the operating ranges for the amplifier), to ensure the correct RF characteristics are present I chose to supply the amplifier with a dedicated 4V rail.
- 3.3V Linear Voltage Regulator
    - Option 1
    - Option 2
- Various Heat Sinks (for Power Amp/MOSFETs/Voltage Regulators)
    - TO-252 Heat Sink (MOSFETs,)
    - TO-262 Heat Sink (5V Regulator,

Reverse Polarity Protection

- I'm basing my design off of this video for several reasons:
    - Low voltage drop (high efficiency)
    - Low Cost
    - Simplicity
- Required Components:
    - P-Channel MOSFET
    - **Note:** A zener diode and 100KOhm resistor could be required for voltage clamping, but I chose a MOSFET with a high maximum gate-source voltage (Vgs) so this is not necessary.