1 MAX889 Charge pump IC

We have MAX889S variant.

PART FREQUENCY C FLY C OUT C IN REGULATED C IN FREE-RUN MAX889S 1MHz 2.2F 10F 10F 2.2F

Output Ripple mV vs Load Current substituting C OUT and a load I=50-100mA , ripple ought to be 5-8mV. Is this OK?

We don't know because we don't know exactly what's inside and there is no indication on the encoder's datasheet as to tolerance of supply noise/ripple. Ripple should be fundamentally located @fOSC which is 1MHz, so filtering should be straightforward given our estimate for encoder signals of DO SUMS

From the datasheet,

$$R_1 \leq \frac{V_{ref}}{30\mu A}$$

$$R_2 < \frac{-V_{out}}{30\mu A}$$

Calculate for 12V input and reference at 5V.

$$R_1 \leq \frac{5}{30\mu A} = 167kR$$

$$R_2 < \frac{5}{30\mu A} = 167kR$$

Choose R1 to be less than or equal 100kR.

$$R_1 = 100kR$$

$$R_2 = R_1 \left(\frac{V_{out}}{-V_{ref}} \right) = \frac{100e3 - 5}{-5} = 100kR$$

Calculate for 12V input and reference at 12V.

$$R_1 \leq \frac{12}{30\mu A} = 400kR$$

$$R_2 < \frac{5}{30\mu A} = 167kR$$

2 Design input filter using spice.

Operating fundamental frequency for encoder: $81,000 * 2 * \pi$ rad rev^{-1} @ 1 rev s^{-1} maximum, $\geq$ 81kHz so cutoff ought to be $>$ 100kHz.

Output O/C impedance is 110 ohms @ 100kHz.

Voltage divider to find 600mV between 0V and 5V:

$$V_{out} = V_{in}\frac{Z_1}{Z_1 + Z_2} \Rightarrow \left(\frac{0.6}{5} - 1\right) Z_1 + \frac{0.6}{5} Z_2 = 0 \Rightarrow Z_1 = \left(\frac{5}{0.6} - 1\right) Z_2$$

If $Z_2 = 100kR$ then $Z_1 = 733kR$

2.1 Schematic model

2.2 Model response

3 Arduino sample rates.

15k SPS or 76.9k SPS at lowest resolution.