ELEN E4215 Instructor: T. Dickson
Fall 2018
Channel Select Filter
Due Date: Tuesday December 11, 2018

1 Project Background

Your company is designing a transceiver for a custom wireless link. You have been assigned to develop a channel select filter for the wireless receiver that will select a 2-MHz channel bandwidth centered around a 10-MHz center frequency. The engineer developing the receiver architecture requires your channel select filter to achieve the design specifications illustrated in Figure 1.

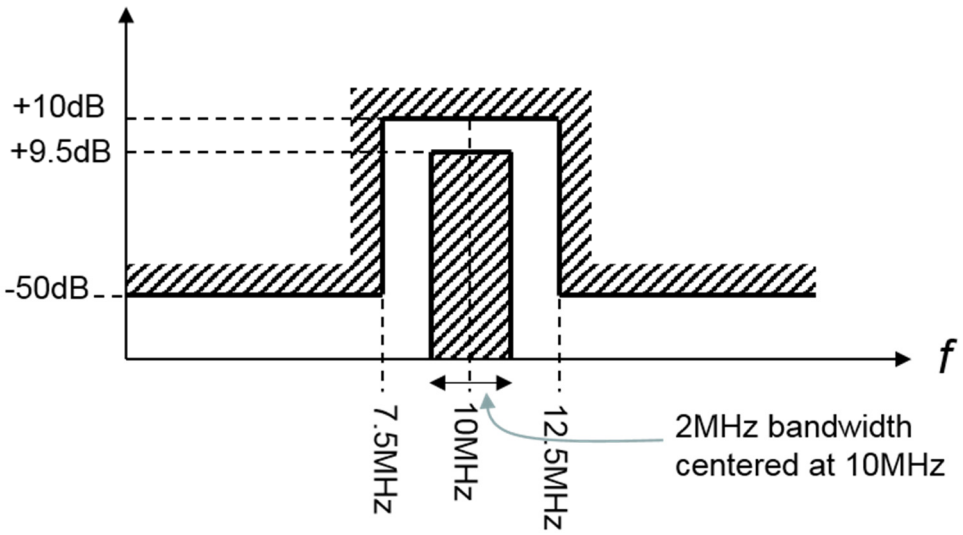

Figure 1: Channel select filter specifications

The filter runs off of dual power supplies of +/- 1V. You can choose to design either an op-amp RC or a Gm-C topology. However, the goal is to come up with as low-power solution as possible while still being able to support an input amplitude of +/- 100mV.

2 Subcomponents

2.1 Op-amps – If you choose an op-amp RC topology, you should determine the required slew rate of the op-amp. The op-amp unity gain frequency should be no higher than 250MHz (but lower is of course acceptable if it can save power while meeting the specifications).

2.2 Transconductors – If you choose a Gm-C topology, your transconductors must have finite output resistance. The product of the transconductance and the output resistance is limited to 100. The ratio of the maximum transconductor output current to the transconductance should be no greater than 300mV.

3 Assessment:

3.1 A report will be submitted from each design group (maximum of 2 students per group, but you can work individually if you prefer – there will be no difference in assessment). Quality of the written report will be assessed, including clarity and organization. The report should be no more than 10 pages, including figures. The IEEE template for transactions articles should be followed:

https://ieeeauthorcenter.ieee.org/create-your-ieee-article/use-authoring-tools-and-ieee-article-templates/ieee-article-templates/templates-for-transactions/

References to the textbook (Schaumann) or the instructor's lecture notes are not required. Any other books or scholarly articles that may have inspired your design should be properly cited.

3.2 You are free to include any information you feel relevant to describing your design into your report. Here are some recommendations of what could be included in a successful report:

- 3.2.1 Filter transfer function – clearly derive the required transfer function. MATLAB plots of the transfer function frequency response are encouraged to verify that the transfer function meets the specifications.
- 3.2.2 Describe the procedure for implementing the transfer function. For example, does your implementation require a cascade of two 2^{nd} order biquads? Two 2^{nd} order plus one 1^{st} order section? What ordering of the sections was chosen, and why?
- 3.2.3 Subcomponents – clearly determine the op-amp or transconductor requirements. Relevant simulations of subcomponent performance (bandwidth, transfer characteristic, output resistance, etc) can be included.
- 3.2.4 Schematics – clearly show all filter and/or sub-section designs, including resistor/capacitor values and how they are determined.
- 3.2.5 Simulation Results – show relevant simulation results for your filter, including:
  - 3.2.5.1 Frequency response
  - 3.2.5.2 Transient simulations to show adequate slew rate, etc.
  - 3.2.5.3 Power consumption (this can be estimated using assumptions that we have discussed in class)
  - 3.2.5.4 Any other sims you feel are relevant to demonstrating your filter performance