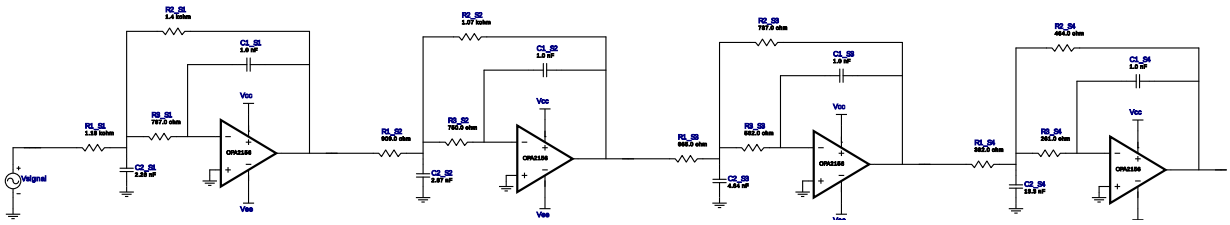
Type : Lowpass
Response : Bessel
Order : 8
Number of Stages : 4

Filter Design Report

Design : Lowpass Filter - 8th order Bessel
Design ID: 2



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty
1.	A1_S1	Texas Instruments Inc.	OPA2156	GbwTyp= 25MHz VccMax= 36V VccMin= 4.5V	1
2.	A1_S2	Texas Instruments Inc.	OPA2156	GbwTyp= 25MHz VccMax= 36V VccMin= 4.5V	1
3.	A1_S3	Texas Instruments Inc.	OPA2156	GbwTyp= 25MHz VccMax= 36V VccMin= 4.5V	1
4.	A1_S4	Texas Instruments Inc.	OPA2156	GbwTyp= 25MHz VccMax= 36V VccMin= 4.5V	1
5.	C1_S1	Generic	Ideal	Cap= 1.0 nF Tolerance= 2.0 %	1
6.	C1_S2	Generic	Ideal	Cap= 1.0 nF Tolerance= 2.0 %	1
7.	C1_S3	Generic	Ideal	Cap= 1.0 nF Tolerance= 2.0 %	1
8.	C1_S4	Generic	Ideal	Cap= 1.0 nF Tolerance= 2.0 %	1
9.	C2_S1	Generic	Ideal	Cap= 2.26 nF Tolerance= 2.0 %	1
10.	C2_S2	Generic	Ideal	Cap= 2.87 nF Tolerance= 2.0 %	1
11.	C2_S3	Generic	Ideal	Cap= 4.64 nF Tolerance= 2.0 %	1
12.	C2_S4	Generic	Ideal	Cap= 13.3 nF Tolerance= 2.0 %	1
13.	R1_S1	Generic	Ideal	Res= 1180.0ohm Tolerance= 1%	1
14.	R1_S2	Generic	Ideal	Res= 909.0ohm Tolerance= 1%	1
15.	R1_S3	Generic	Ideal	Res= 665.0ohm Tolerance= 1%	1
16.	R1_S4	Generic	Ideal	Res= 392.0ohm Tolerance= 1%	1
17.	R2_S1	Generic	Ideal	Res= 1400.0ohm Tolerance= 1%	1

#	Name	Manufacturer	Part Number	Properties	Qty
18.	R2_S2	Generic	Ideal	Res= 1070.0ohm Tolerance= 1%	1
19.	R2_S3	Generic	Ideal	Res= 787.0ohm Tolerance= 1%	1
20.	R2_S4	Generic	Ideal	Res= 464.0ohm Tolerance= 1%	1
21.	R3_S1	Generic	Ideal	Res= 787.0ohm Tolerance= 1%	1
22.	R3_S2	Generic	Ideal	Res= 750.0ohm Tolerance= 1%	1
23.	R3_S3	Generic	Ideal	Res= 562.0ohm Tolerance= 1%	1
24.	R3_S4	Generic	Ideal	Res= 261.0ohm Tolerance= 1%	1

Sensitivity Analysis

#	Name	Series	Tolerance
1.	Cap	E48	2%
2.	Res	E96	1%

Design Inputs

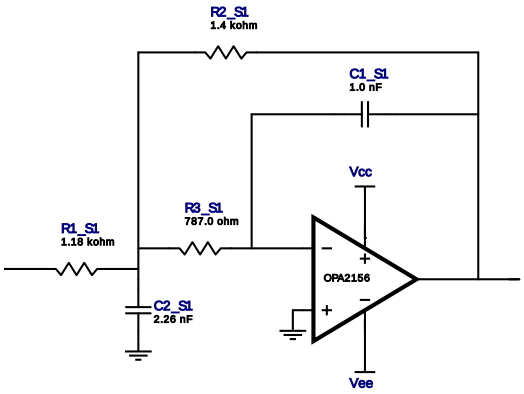
#	Name	Value	Description
1.	FilterType	lowpass	
2.	FilterResponse	Bessel	
3.	FilterOrder	8.0	
4.	FilterTopology	Multiple Feedback	
5.	NumberOfStages	4.0	
6.	PassbandFrequency	56.8 k	
7.	StopbandAttenuation	-114.194	
8.	StopbandFrequency	568.0 k	
9.	Gain	2.0	
10.	DualSupply	+/-5.00 V	Power supply(s) to active chips
11.	ResistorTolerance	E96	Resistor series - 1% Passive resistor tolerance
12.	CapacitorTolerance	E48	Capacitor series - 2% Passive capacitor tolerance

Design Assistance

1. **OPA2156** Product Folder : http://www.ti.com/product/OPA2156 : contains the data sheet and other resources.

Filter Stage :1

Cutoff Frequency	100.859 kHz
Min GBW Reqd	6.097 MHz
Stage Gain	1.186 V/V
Stage Q	505.649 m
Stage Topology	Multiple Feedback

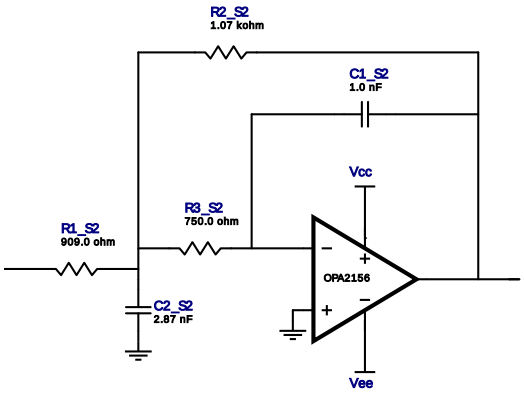


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty
1.	A1_S1	Texas Instruments Inc.	OPA2156	GbwTyp= 25MHz VccMax= 36V VccMin= 4.5V	1
2.	C1_S1	Generic	Ideal	Cap= 1.0 nF Tolerance= 2.0 %	1
3.	C2_S1	Generic	Ideal	Cap= 2.26 nF Tolerance= 2.0 %	1
4.	R1_S1	Generic	Ideal	Res= 1180.0ohm Tolerance= 1%	1
5.	R2_S1	Generic	Ideal	Res= 1400.0ohm Tolerance= 1%	1
6.	R3_S1	Generic	Ideal	Res= 787.0ohm Tolerance= 1%	1

Filter Stage :2

Cutoff Frequency	104.871 kHz
Min GBW Reqd	6.946 MHz
Stage Gain	1.177 V/V
Stage Q	561.492 m
Stage Topology	Multiple Feedback

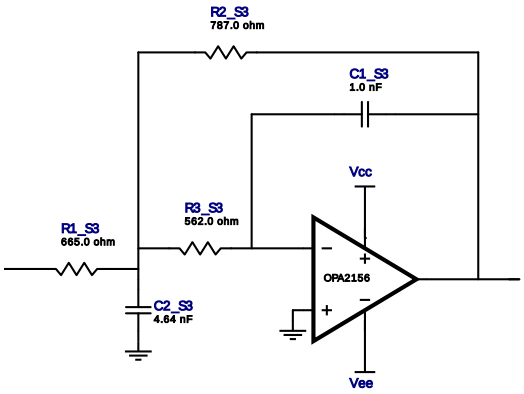


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty
1.	A1_S2	Texas Instruments Inc.	OPA2156	GbwTyp= 25MHz VccMax= 36V VccMin= 4.5V	1
2.	C1_S2	Generic	Ideal	Cap= 1.0 nF Tolerance= 2.0 %	1
3.	C2_S2	Generic	Ideal	Cap= 2.87 nF Tolerance= 2.0 %	1
4.	R1_S2	Generic	Ideal	Res= 909.0ohm Tolerance= 1%	1
5.	R2_S2	Generic	Ideal	Res= 1070.0ohm Tolerance= 1%	1
6.	R3_S2	Generic	Ideal	Res= 750.0ohm Tolerance= 1%	1

Filter Stage :3

Cutoff Frequency	111.098 kHz
Min GBW Reqd	9.407 MHz
Stage Gain	1.183 V/V
Stage Q	711.267 m
Stage Topology	Multiple Feedback

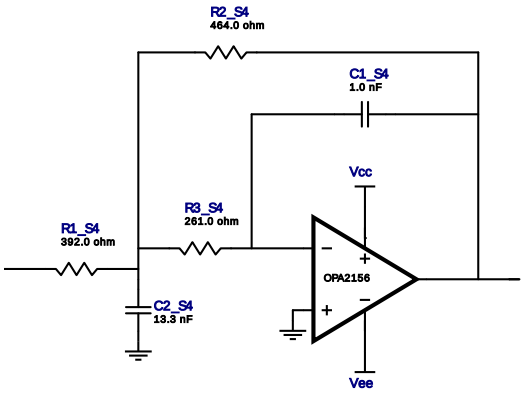


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty
1.	A1_S3	Texas Instruments Inc.	OPA2156	GbwTyp= 25MHz VccMax= 36V VccMin= 4.5V	1
2.	C1_S3	Generic	Ideal	Cap= 1.0 nF Tolerance= 2.0 %	1
3.	C2_S3	Generic	Ideal	Cap= 4.64 nF Tolerance= 2.0 %	1
4.	R1_S3	Generic	Ideal	Res= 665.0ohm Tolerance= 1%	1
5.	R2_S3	Generic	Ideal	Res= 787.0ohm Tolerance= 1%	1
6.	R3_S3	Generic	Ideal	Res= 562.0ohm Tolerance= 1%	1

Filter Stage :4

Cutoff Frequency	125.405 kHz
Min GBW Reqd	18.177 MHz
Stage Gain	1.184 V/V
Stage Q	1.227
Stage Topology	Multiple Feedback



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty
1.	A1_S4	Texas Instruments Inc.	OPA2156	GbwTyp= 25MHz VccMax= 36V VccMin= 4.5V	1
2.	C1_S4	Generic	Ideal	Cap= 1.0 nF Tolerance= 2.0 %	1
3.	C2_S4	Generic	Ideal	Cap= 13.3 nF Tolerance= 2.0 %	1
4.	R1_S4	Generic	Ideal	Res= 392.0ohm Tolerance= 1%	1
5.	R2_S4	Generic	Ideal	Res= 464.0ohm Tolerance= 1%	1
6.	R3_S4	Generic	Ideal	Res= 261.0ohm Tolerance= 1%	1