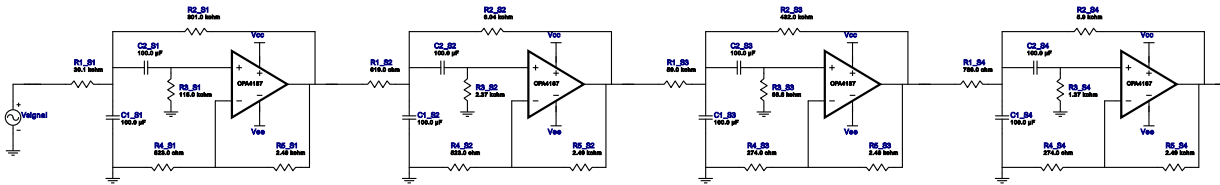


Type : Bandpass
 Response : Bessel
 Order : 8
 Number of Stages : 4

Filter Design Report

Design : Bandpass Filter - 8th order Bessel
 Design ID: 12



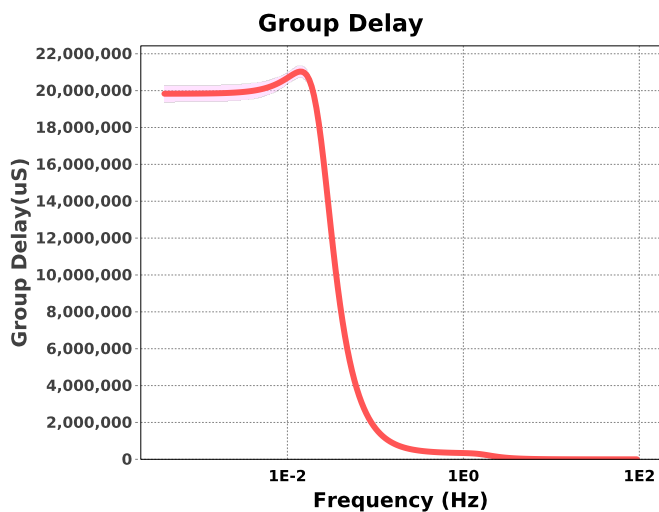
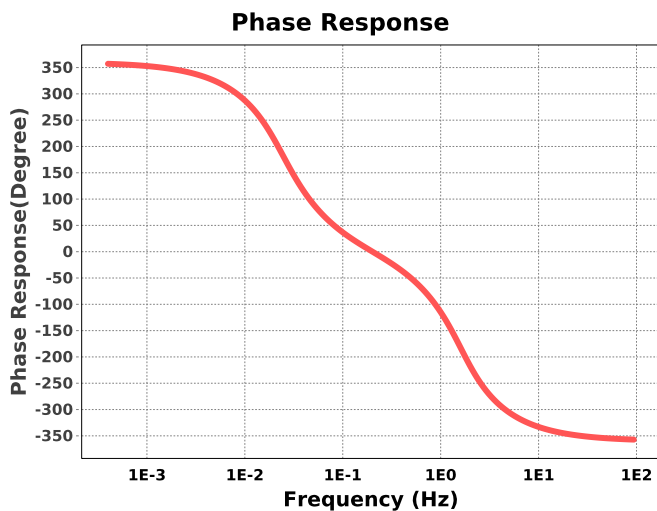
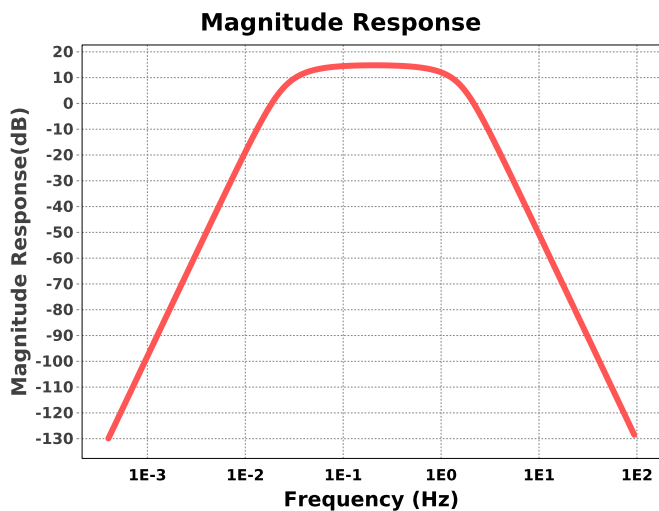
Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty
1.	A1_S1	Texas Instruments Inc.	OPA4187	GbwTyp= 0.55MHz VccMax= 36V VccMin= 4.5V	1
2.	A1_S2	Texas Instruments Inc.	OPA4187	GbwTyp= 0.55MHz VccMax= 36V VccMin= 4.5V	1
3.	A1_S3	Texas Instruments Inc.	OPA4187	GbwTyp= 0.55MHz VccMax= 36V VccMin= 4.5V	1
4.	A1_S4	Texas Instruments Inc.	OPA4187	GbwTyp= 0.55MHz VccMax= 36V VccMin= 4.5V	1
5.	C1_S1	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
6.	C1_S2	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
7.	C1_S3	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
8.	C1_S4	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
9.	C2_S1	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
10.	C2_S2	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
11.	C2_S3	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
12.	C2_S4	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
13.	R1_S1	Generic	Ideal	Res= 30100.0ohm Tolerance= 1%	1
14.	R1_S2	Generic	Ideal	Res= 619.0ohm Tolerance= 1%	1
15.	R1_S3	Generic	Ideal	Res= 59000.0ohm Tolerance= 1%	1
16.	R1_S4	Generic	Ideal	Res= 768.0ohm Tolerance= 1%	1
17.	R2_S1	Generic	Ideal	Res= 301000.0ohm Tolerance= 1%	1

#	Name	Manufacturer	Part Number	Properties	Qty
18.	R2_S2	Generic	Ideal	Res= 6040.0ohm Tolerance= 1%	1
19.	R2_S3	Generic	Ideal	Res= 432000.0ohm Tolerance= 1%	1
20.	R2_S4	Generic	Ideal	Res= 5900.0ohm Tolerance= 1%	1
21.	R3_S1	Generic	Ideal	Res= 115000.0ohm Tolerance= 1%	1
22.	R3_S2	Generic	Ideal	Res= 2370.0ohm Tolerance= 1%	1
23.	R3_S3	Generic	Ideal	Res= 86600.0ohm Tolerance= 1%	1
24.	R3_S4	Generic	Ideal	Res= 1370.0ohm Tolerance= 1%	1
25.	R4_S1	Generic	Ideal	Res= 523.0ohm Tolerance= 1%	1
26.	R4_S2	Generic	Ideal	Res= 523.0ohm Tolerance= 1%	1
27.	R4_S3	Generic	Ideal	Res= 274.0ohm Tolerance= 1%	1
28.	R4_S4	Generic	Ideal	Res= 274.0ohm Tolerance= 1%	1
29.	R5_S1	Generic	Ideal	Res= 2490.0ohm Tolerance= 1%	1
30.	R5_S2	Generic	Ideal	Res= 2490.0ohm Tolerance= 1%	1
31.	R5_S3	Generic	Ideal	Res= 2490.0ohm Tolerance= 1%	1
32.	R5_S4	Generic	Ideal	Res= 2490.0ohm Tolerance= 1%	1

Sensitivity Analysis

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



Design Inputs

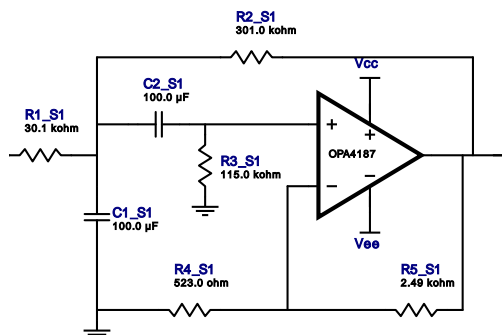
#	Name	Value	Description
1.	FilterType	bandpass	
2.	FilterResponse	Bessel	
3.	FilterOrder	8.0	
4.	FilterTopology	Sallen-Key	
5.	NumberOfStages	4.0	
6.	CenterFrequency	200.0 m	
7.	StopbandAttenuation	-65.946	
8.	PassbandBandwidth	1.0	
9.	StopbandBandwidth	10.0	
10.	Gain	5.623	
11.	DualSupply	+/-5.00 V	Power supply(s) to active chips
12.	ResistorTolerance	E96	Resistor series - 1% Passive resistor tolerance
13.	CapacitorTolerance	E48	Capacitor series - 2% Passive capacitor tolerance

Design Assistance

1. **OPA4187** Product Folder : <http://www.ti.com/product/OPA4187> : contains the data sheet and other resources.

Filter Stage :1

Cutoff Frequency 28.372 mHz
 Min GBW Req'd 8.592 Hz
 Stage Gain 5.761 V/V
 Stage Q 512.303 m
 Stage Topology Sallen-Key

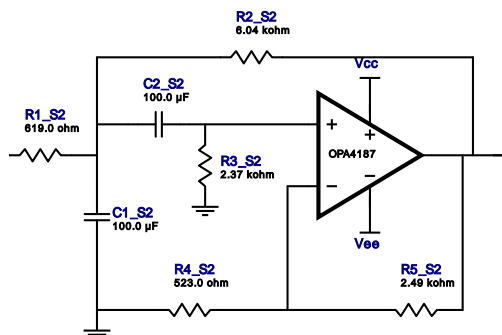


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty
1.	A1_S1	Texas Instruments Inc.	OPA4187	GbwTyp= 0.55MHz VccMax= 36V VccMin= 4.5V	1
2.	C1_S1	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
3.	C2_S1	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
4.	R1_S1	Generic	Ideal	Res= 30100.0ohm Tolerance= 1%	1
5.	R2_S1	Generic	Ideal	Res= 301000.0ohm Tolerance= 1%	1
6.	R3_S1	Generic	Ideal	Res= 115000.0ohm Tolerance= 1%	1
7.	R4_S1	Generic	Ideal	Res= 523.0ohm Tolerance= 1%	1
8.	R5_S1	Generic	Ideal	Res= 2490.0ohm Tolerance= 1%	1

Filter Stage :2

Cutoff Frequency 1.38 Hz
 Min GBW Req'd 418.366 Hz
 Stage Gain 5.761 V/V
 Stage Q 518.743 m
 Stage Topology Sallen-Key

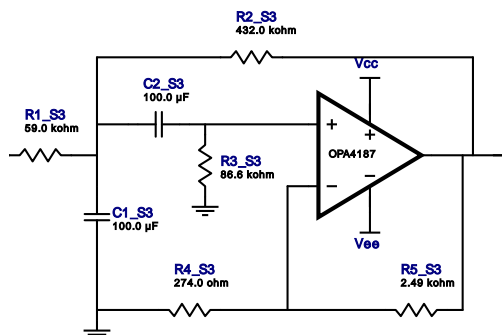


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty
1.	A1_S2	Texas Instruments Inc.	OPA4187	GbwTyp= 0.55MHz VccMax= 36V VccMin= 4.5V	1
2.	C1_S2	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
3.	C2_S2	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
4.	R1_S2	Generic	Ideal	Res= 619.0ohm Tolerance= 1%	1
5.	R2_S2	Generic	Ideal	Res= 6040.0ohm Tolerance= 1%	1
6.	R3_S2	Generic	Ideal	Res= 2370.0ohm Tolerance= 1%	1
7.	R4_S2	Generic	Ideal	Res= 523.0ohm Tolerance= 1%	1
8.	R5_S2	Generic	Ideal	Res= 2490.0ohm Tolerance= 1%	1

Filter Stage :3

Cutoff Frequency 23.737 mHz
 Min GBW Req'd 20.697 Hz
 Stage Gain 10.088 V/V
 Stage Q 784.663 m
 Stage Topology Sallen-Key

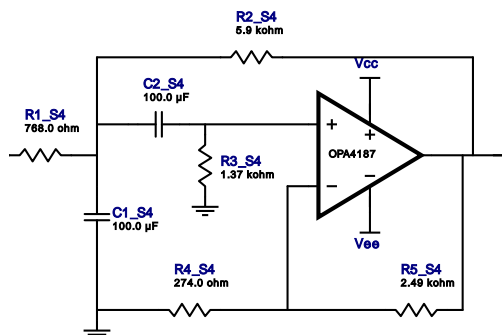


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty
1.	A1_S3	Texas Instruments Inc.	OPA4187	GbwTyp= 0.55MHz VccMax= 36V VccMin= 4.5V	1
2.	C1_S3	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
3.	C2_S3	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
4.	R1_S3	Generic	Ideal	Res= 59000.0ohm Tolerance= 1%	1
5.	R2_S3	Generic	Ideal	Res= 432000.0ohm Tolerance= 1%	1
6.	R3_S3	Generic	Ideal	Res= 86600.0ohm Tolerance= 1%	1
7.	R4_S3	Generic	Ideal	Res= 274.0ohm Tolerance= 1%	1
8.	R5_S3	Generic	Ideal	Res= 2490.0ohm Tolerance= 1%	1

Filter Stage :4

Cutoff Frequency 1.649 Hz
 Min GBW Req'd 1.321 kHz
 Stage Gain 10.088 V/V
 Stage Q 848.355 m
 Stage Topology Sallen-Key



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty
1.	A1_S4	Texas Instruments Inc.	OPA4187	GbwTyp= 0.55MHz VccMax= 36V VccMin= 4.5V	1
2.	C1_S4	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
3.	C2_S4	Generic	Ideal	Cap= 100.0 uF Tolerance= 2.0 %	1
4.	R1_S4	Generic	Ideal	Res= 768.0ohm Tolerance= 1%	1
5.	R2_S4	Generic	Ideal	Res= 5900.0ohm Tolerance= 1%	1
6.	R3_S4	Generic	Ideal	Res= 1370.0ohm Tolerance= 1%	1
7.	R4_S4	Generic	Ideal	Res= 274.0ohm Tolerance= 1%	1

#	Name	Manufacturer	Part Number	Properties	Qty
8.	R5_S4	Generic	Ideal	Res= 2490.0ohm Tolerance= 1%	1

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