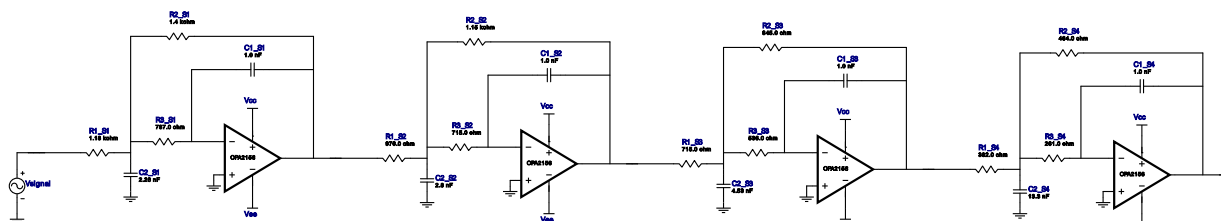


## Filter Design Report

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= 1.0 %	1
6.	C1_S2	Generic	Ideal	Cap= 1.0 nF Tolerance= 1.0 %	1
7.	C1_S3	Generic	Ideal	Cap= 1.0 nF Tolerance= 1.0 %	1
8.	C1_S4	Generic	Ideal	Cap= 1.0 nF Tolerance= 1.0 %	1
9.	C2_S1	Generic	Ideal	Cap= 2.26 nF Tolerance= 1.0 %	1
10.	C2_S2	Generic	Ideal	Cap= 2.8 nF Tolerance= 1.0 %	1
11.	C2_S3	Generic	Ideal	Cap= 4.53 nF Tolerance= 1.0 %	1
12.	C2_S4	Generic	Ideal	Cap= 13.3 nF Tolerance= 1.0 %	1
13.	R1_S1	Generic	Ideal	Res= 1180.0ohm Tolerance= 1%	1
14.	R1_S2	Generic	Ideal	Res= 976.0ohm Tolerance= 1%	1
15.	R1_S3	Generic	Ideal	Res= 715.0ohm 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= 1150.0ohm Tolerance= 1%	1
19.	R2_S3	Generic	Ideal	Res= 845.0ohm 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= 715.0ohm Tolerance= 1%	1
23.	R3_S3	Generic	Ideal	Res= 536.0ohm Tolerance= 1%	1
24.	R3_S4	Generic	Ideal	Res= 261.0ohm Tolerance= 1%	1

## Sensitivity Analysis

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

## Design Inputs

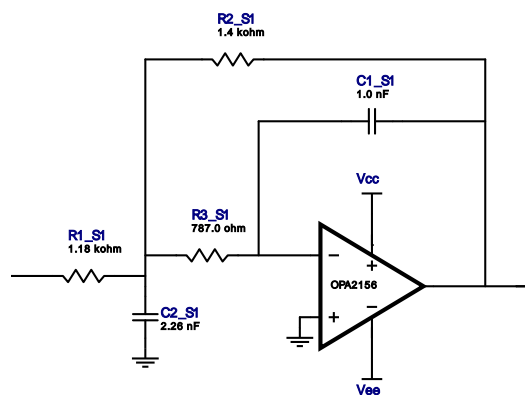
#	Name	Value	Description
1.	FilterType	lowpass	
2.	FilterResponse	Bessel	
3.	FilterOrder	8.0	
4.	FilterTopology	Multiple Feedback	
5.	NumberOfStages	4.0	
6.	PassbandFrequency	56.8 k	
7.	StopbandAttenuation	-114.194	
8.	StopbandFrequency	568.0 k	
9.	Gain	2.0	
10.	DualSupply	+/-5.00 V	Power supply(s) to active chips
11.	ResistorTolerance	E96	Resistor series - 1% Passive resistor tolerance
12.	CapacitorTolerance	E96	Capacitor series - 1% 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 Req'd        6.097 MHz  
 Stage Gain            1.186 V/V  
 Stage Q                505.649 m  
 Stage Topology        Multiple Feedback

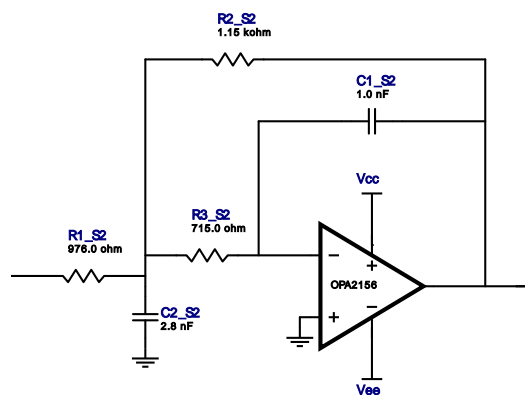


## Electrical BOM

#	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= 1.0 %	1
3.	C2_S1	Generic	Ideal	Cap= 2.26 nF Tolerance= 1.0 %	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      104.891 kHz  
 Min GBW Req'd        6.946 MHz  
 Stage Gain             1.178 V/V  
 Stage Q                560.425 m  
 Stage Topology        Multiple Feedback

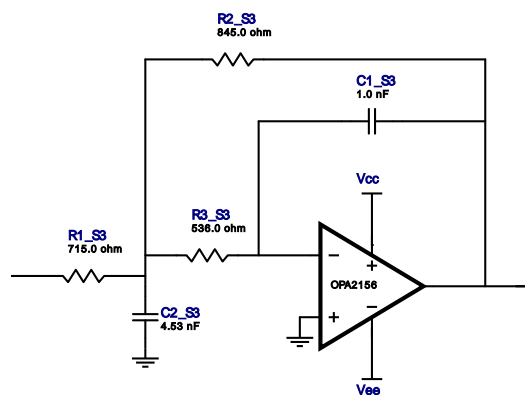


### Electrical BOM

#	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= 1.0 %	1
3.	C2_S2	Generic	Ideal	Cap= 2.8 nF Tolerance= 1.0 %	1
4.	R1_S2	Generic	Ideal	Res= 976.0ohm Tolerance= 1%	1
5.	R2_S2	Generic	Ideal	Res= 1150.0ohm Tolerance= 1%	1
6.	R3_S2	Generic	Ideal	Res= 715.0ohm Tolerance= 1%	1

## Filter Stage :3

Cutoff Frequency      111.112 kHz  
 Min GBW Req'd        9.407 MHz  
 Stage Gain             1.182 V/V  
 Stage Q                711.054 m  
 Stage Topology        Multiple Feedback

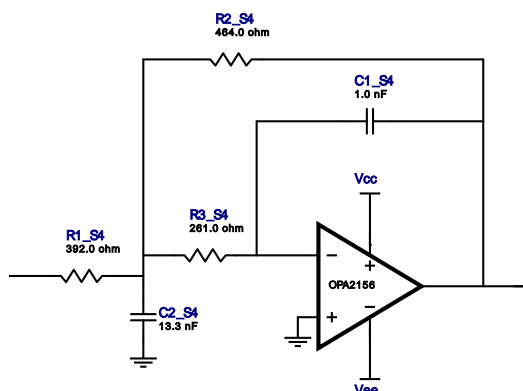


## Electrical BOM

#	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= 1.0 %	1
3.	C2_S3	Generic	Ideal	Cap= 4.53 nF Tolerance= 1.0 %	1
4.	R1_S3	Generic	Ideal	Res= 715.0ohm Tolerance= 1%	1
5.	R2_S3	Generic	Ideal	Res= 845.0ohm Tolerance= 1%	1
6.	R3_S3	Generic	Ideal	Res= 536.0ohm Tolerance= 1%	1

## Filter Stage :4

Cutoff Frequency      125.405 kHz  
 Min GBW Req'd        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= 1.0 %	1
3.	C2_S4	Generic	Ideal	Cap= 13.3 nF Tolerance= 1.0 %	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

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