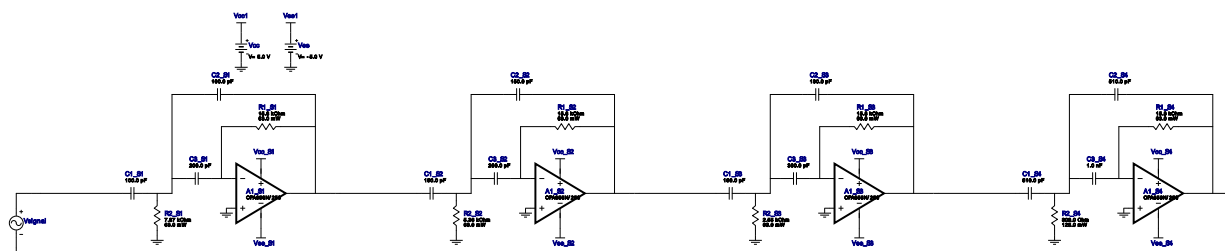


## WEBENCH<sup>®</sup> Design Report

Design : 4445574/1 OPA656N/250  
Highpass, Multiple Feedback, Butterworth



### My Comments

No comments

### Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S1	Texas Instruments	OPA656N/250	GbwTyp= 500.0MHz VccMin= 7.0 V VccMax= 13.0 V	1	\$5.75	 SOT-23 14 mm²
2.	A1_S2	Texas Instruments	OPA656N/250	GbwTyp= 500.0MHz VccMin= 7.0 V VccMax= 13.0 V	1	\$5.75	 SOT-23 14 mm²
3.	A1_S3	Texas Instruments	OPA656N/250	GbwTyp= 500.0MHz VccMin= 7.0 V VccMax= 13.0 V	1	\$5.75	 SOT-23 14 mm²
4.	A1_S4	Texas Instruments	OPA656N/250	GbwTyp= 500.0MHz VccMin= 7.0 V VccMax= 13.0 V	1	\$5.75	 SOT-23 14 mm²
5.	C1_S1	Kemet	C0603C101J3GACTU Series= C0G/NP0	Cap= 100.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm²
6.	C1_S2	Johanson Technology	250R07N151JV4T Series= C0G/NP0	Cap= 150.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm²
7.	C1_S3	Samsung Electro-Mechanics	CL05C181JA5NNNC Series= C0G/NP0	Cap= 180.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm²
8.	C1_S4	MuRata	GRM1555C1E511JA01D Series= C0G/NP0	Cap= 510.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm²
9.	C2_S1	Kemet	C0603C101J3GACTU Series= C0G/NP0	Cap= 100.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm²
10.	C2_S2	Johanson Technology	250R07N151JV4T Series= C0G/NP0	Cap= 150.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm²
11.	C2_S3	Samsung Electro-Mechanics	CL05C181JA5NNNC Series= C0G/NP0	Cap= 180.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm²
12.	C2_S4	MuRata	GRM1555C1E511JA01D Series= C0G/NP0	Cap= 510.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm²
13.	C3_S1	Samsung Electro-Mechanics	CL05C201JB5NNNC Series= C0G/NP0	Cap= 200.0 pF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
14.	C3_S2	Samsung Electro-Mechanics	CL05C201JB5NNNC Series= C0G/NP0	Cap= 200.0 pF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	0402 3 mm <sup>2</sup>
15.	C3_S3	MuRata	GRM1555C1E361JA01D Series= C0G/NP0	Cap= 360.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	0402 3 mm <sup>2</sup>
16.	C3_S4	Samsung Electro-Mechanics	CL05C102JO5NNNC Series= C0G/NP0	Cap= 1.0 nF VDC= 16.0 V Tolerance= 5.0 %	1	\$0.01	0402 3 mm <sup>2</sup>
17.	R1_S1	Vishay-Dale	CRCW040215K8FKED Series= CRCW..e3	Res= 15.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
18.	R1_S2	Vishay-Dale	CRCW040215K8FKED Series= CRCW..e3	Res= 15.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
19.	R1_S3	Vishay-Dale	CRCW040215K8FKED Series= CRCW..e3	Res= 15.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
20.	R1_S4	Vishay-Dale	CRCW040215K8FKED Series= CRCW..e3	Res= 15.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
21.	R2_S1	Vishay-Dale	CRCW04027K87FKED Series= CRCW..e3	Res= 7.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
22.	R2_S2	Vishay-Dale	CRCW04025K36FKED Series= CRCW..e3	Res= 5.36 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
23.	R2_S3	Vishay-Dale	CRCW04022K55FKED Series= CRCW..e3	Res= 2.55 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
24.	R2_S4	Vishay-Dale	CRCW0805309RFKEA Series= CRCW..e3	Res= 309.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm <sup>2</sup>

## Design Inputs

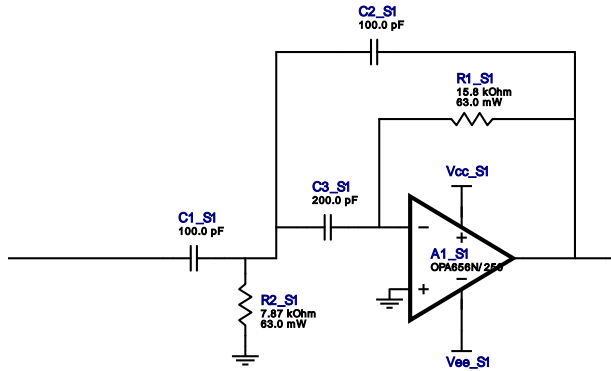
#	Name	Value	Description
1.	FilterType	Highpass	
2.	FilterResponse	Butterworth	
3.	FilterOrder	8.0	
4.	FilterTopology	Multiple_Feedback	
5.	NumberOfStages	4.0	
6.	PassbandFrequency	100.0 k	
7.	StopbandAttenuation	-45.0	
8.	StopbandFrequency	50.0 k	
9.	Gain	1.0	
10.	DualSupply	+/-5.0 V	Power supply(s) to active chips
11.	ResistorTolerance	E96	Resistor series - 1% Passive resistor tolerance
12.	CapacitorTolerance	E24	Capacitor series - 5% Passive capacitance tolerance
13.	SeedCapacitance	100.0 p	Seed Capacitance to start design of filter

## Design Assistance







1. **OPA656N/250** Product Folder : <http://www.ti.com//product/OPA656> : contains the data sheet and other resources.

## Filter Stage :1

Cutoff Frequency 100.0 kHz  
 Min GBW Req'd 5.1 MHz  
 Stage Gain 1.0 V/V  
 Stage Q 510.0 m  
 Stage Topology Multiple\_Feedback

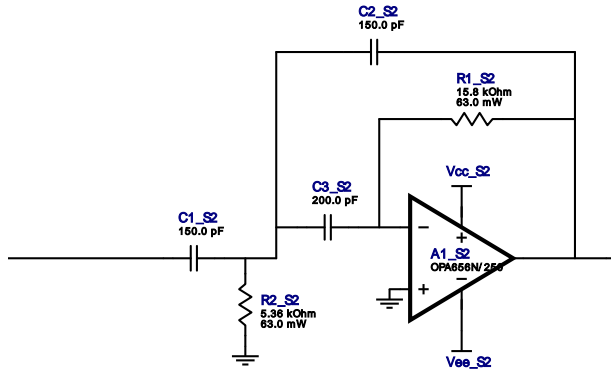


## Electrical BOM







#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S1	Texas Instruments	OPA656N/250	GbwTyp= 500.0MHz VccMin= 7.0 V VccMax= 13.0 V	1	\$5.75	 SOT-23 14 mm <sup>2</sup>
2.	C1_S1	Kemet	C0603C101J3GACTU Series= C0G/NP0	Cap= 100.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm <sup>2</sup>
3.	C2_S1	Kemet	C0603C101J3GACTU Series= C0G/NP0	Cap= 100.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm <sup>2</sup>
4.	C3_S1	Samsung Electro-Mechanics	CL05C201JB5NNNC Series= C0G/NP0	Cap= 200.0 pF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm <sup>2</sup>
5.	R1_S1	Vishay-Dale	CRCW040215K8FKED Series= CRCW..e3	Res= 15.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
6.	R2_S1	Vishay-Dale	CRCW04027K87FKED Series= CRCW..e3	Res= 7.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>

## Filter Stage :2

Cutoff Frequency 100.0 kHz  
 Min GBW Req'd 6.0 MHz  
 Stage Gain 1.0 V/V  
 Stage Q 600.0 m  
 Stage Topology Multiple\_Feedback

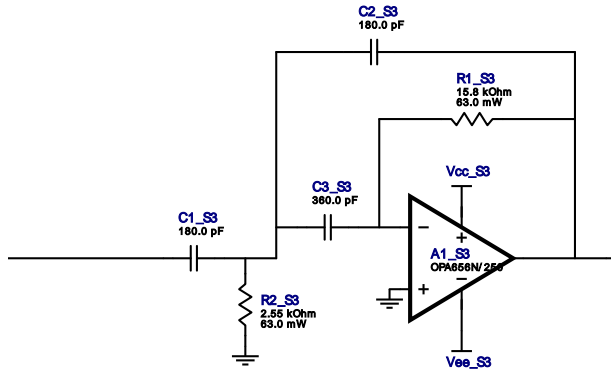


### Electrical BOM







#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S2	Texas Instruments	OPA656N/250	GbwTyp= 500.0MHz VccMin= 7.0 V VccMax= 13.0 V	1	\$5.75	 SOT-23 14 mm <sup>2</sup>
2.	C1_S2	Johanson Technology	250R07N151JV4T Series= C0G/NP0	Cap= 150.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm <sup>2</sup>
3.	C2_S2	Johanson Technology	250R07N151JV4T Series= C0G/NP0	Cap= 150.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm <sup>2</sup>
4.	C3_S2	Samsung Electro-Mechanics	CL05C201JB5NNNC Series= C0G/NP0	Cap= 200.0 pF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm <sup>2</sup>
5.	R1_S2	Vishay-Dale	CRCW040215K8FKED Series= CRCW..e3	Res= 15.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
6.	R2_S2	Vishay-Dale	CRCW04025K36FKED Series= CRCW..e3	Res= 5.36 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>

## Filter Stage :3

Cutoff Frequency 100.0 kHz  
 Min GBW Req'd 9.0 MHz  
 Stage Gain 1.0 V/V  
 Stage Q 900.0 m  
 Stage Topology Multiple\_Feedback

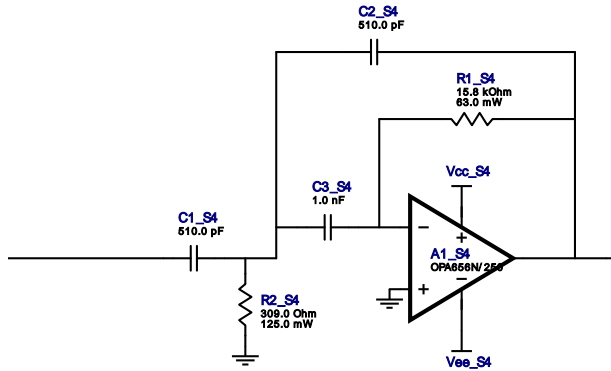


### Electrical BOM






#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S3	Texas Instruments	OPA656N/250	GbwTyp= 500.0MHz VccMin= 7.0 V VccMax= 13.0 V	1	\$5.75	 SOT-23 14 mm <sup>2</sup>
2.	C1_S3	Samsung Electro-Mechanics	CL05C181JA5NNNC Series= C0G/NP0	Cap= 180.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm <sup>2</sup>
3.	C2_S3	Samsung Electro-Mechanics	CL05C181JA5NNNC Series= C0G/NP0	Cap= 180.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm <sup>2</sup>
4.	C3_S3	MuRata	GRM1555C1E361JA01D Series= C0G/NP0	Cap= 360.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm <sup>2</sup>
5.	R1_S3	Vishay-Dale	CRCW040215K8FKED Series= CRCW..e3	Res= 15.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
6.	R2_S3	Vishay-Dale	CRCW04022K55FKED Series= CRCW..e3	Res= 2.55 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>


## Filter Stage :4

Cutoff Frequency 100.0 kHz  
 Min GBW Req'd 25.6 MHz  
 Stage Gain 1.0 V/V  
 Stage Q 2.56  
 Stage Topology Multiple\_Feedback



### Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S4	Texas Instruments	OPA656N/250	GbwTyp= 500.0MHz VccMin= 7.0 V VccMax= 13.0 V	1	\$5.75	 SOT-23 14 mm <sup>2</sup>
2.	C1_S4	MuRata	GRM1555C1E511JA01D Series= C0G/NP0	Cap= 510.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm <sup>2</sup>
3.	C2_S4	MuRata	GRM1555C1E511JA01D Series= C0G/NP0	Cap= 510.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm <sup>2</sup>
4.	C3_S4	Samsung Electro-Mechanics	CL05C102JO5NNNC Series= C0G/NP0	Cap= 1.0 nF VDC= 16.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm <sup>2</sup>
5.	R1_S4	Vishay-Dale	CRCW040215K8FKED Series= CRCW..e3	Res= 15.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
6.	R2_S4	Vishay-Dale	CRCW0805309RFKEA Series= CRCW..e3	Res= 309.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>

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