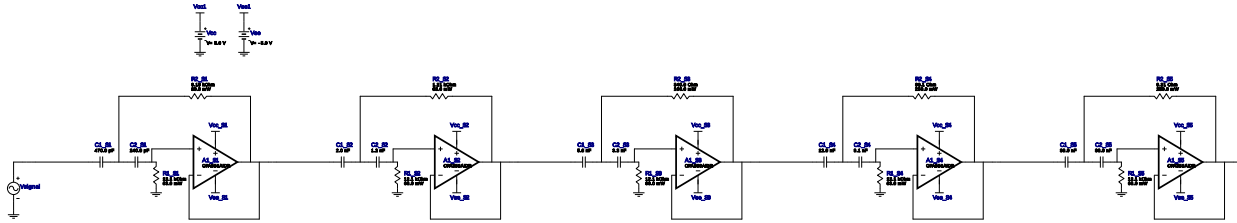


WEBENCH[®] Design Report

Design : 4738714/16 OPA356AIDR
Highpass, Sallen Key, Chebyshev 0.5 dB



My Comments

No comments

Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S1	Texas Instruments, Inc.	OPA356AIDR	GbwTyp= 450.0MHz VccMin= 2.5 V VccMax= 5.5 V	1	\$0.70	 D0008A 57 mm ²
2.	A1_S2	Texas Instruments, Inc.	OPA356AIDR	GbwTyp= 450.0MHz VccMin= 2.5 V VccMax= 5.5 V	1	\$0.70	 D0008A 57 mm ²
3.	A1_S3	Texas Instruments, Inc.	OPA356AIDR	GbwTyp= 450.0MHz VccMin= 2.5 V VccMax= 5.5 V	1	\$0.70	 D0008A 57 mm ²
4.	A1_S4	Texas Instruments, Inc.	OPA356AIDR	GbwTyp= 450.0MHz VccMin= 2.5 V VccMax= 5.5 V	1	\$0.70	 D0008A 57 mm ²
5.	A1_S5	Texas Instruments, Inc.	OPA356AIDR	GbwTyp= 450.0MHz VccMin= 2.5 V VccMax= 5.5 V	1	\$0.70	 D0008A 57 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
6.	C1_S1	MuRata	GRM1555C1E471JA01D Series= C0G/NP0	Cap= 470.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm ²
7.	C1_S2	MuRata	GRM1885C1H202JA01D Series= C0G/NP0	Cap= 2.0 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm ²
8.	C1_S3	TDK	C1608C0G1E562J080AA Series= C0G/NP0	Cap= 5.6 nF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.06	 0603 5 mm ²
9.	C1_S4	AVX	06033C123JAT2A Series= X7R	Cap= 12.0 nF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.06	 0603 5 mm ²
10.	C1_S5	AVX	12065A392JAT2A Series= C0G/NP0	Cap= 39.0 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.09	 1206 11 mm ²
11.	C2_S1	Samsung Electro-Mechanics	CL10C241JB8NNNC Series= C0G/NP0	Cap= 240.0 pF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm ²
12.	C2_S2	Samsung Electro-Mechanics	CL10C122JB8NNNC Series= C0G/NP0	Cap= 1.2 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm ²
13.	C2_S3	MuRata	GRM1885C1H332JA01D Series= C0G/NP0	Cap= 3.3 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm ²
14.	C2_S4	MuRata	GRM2195C1H912JA01D Series= C0G/NP0	Cap= 9.1 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.06	 0805 7 mm ²
15.	C2_S5	AVX	08053A332JAT2A Series= C0G/NP0	Cap= 33.0 nF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.06	 0805 7 mm ²
16.	R1_S1	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
17.	R1_S2	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
18.	R1_S3	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
19.	R1_S4	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
20.	R1_S5	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
21.	R2_S1	Vishay-Dale	CRCW04026K19FKED Series= CRCW..e3	Res= 6.19 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
22.	R2_S2	Vishay-Dale	CRCW04021K21FKED Series= CRCW..e3	Res= 1.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
23.	R2_S3	Vishay-Dale	CRCW0603340RFKEA Series= CRCW..e3	Res= 340.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
24.	R2_S4	Panasonic	ERJ-8ENF93R1V Series= ERJ-8E	Res= 93.1 Ohm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
25.	R2_S5	Vishay-Dale	CRCW12069R31FKEA Series= CRCW..e3	Res= 9.31 Ohm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²

Design Inputs

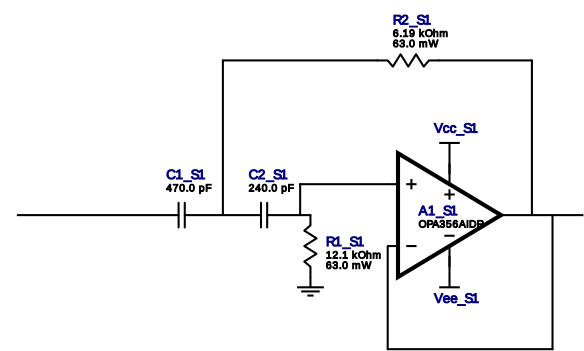
#	Name	Value	Description
1.	FilterType	Highpass	
2.	FilterResponse	Chebyshev_05dB	
3.	FilterOrder	10.0	
4.	FilterTopology	Sallen_Key	
5.	NumberOfStages	5.0	
6.	PassbandFrequency	13.0 k	
7.	StopbandAttenuation	-45.0	
8.	StopbandFrequency	10.0 k	
9.	Gain	1.0	
10.	DualSupply	+/-5.0 V	Power supply(s) to active chips
11.	ResistorTolerance	E96	Resistor series - 1% Passive resistor tolerance
12.	CapacitorTolerance	E24	Capacitor series - 5% Passive capacitance tolerance
13.	SeedCapacitance	1.0 n	Seed Capacitance to start design of filter

Design Assistance

1. **OPA356AIDR** Product Folder : <http://www.ti.com/product/OPA356> : contains the data sheet and other resources.

Filter Stage :1

Cutoff Frequency 54.799 kHz
Min GBW Req'd 3.688 MHz
Stage Gain 1.0 V/V
Stage Q 673.0 m
Stage Topology Sallen_Key

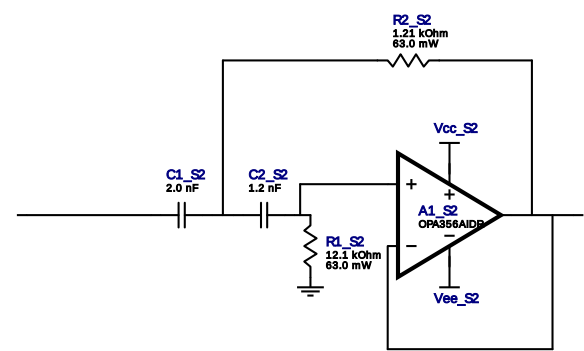


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S1	Texas Instruments, Inc.	OPA356AIDR	GbwTyp= 450.0MHz VccMin= 2.5 V VccMax= 5.5 V	1	\$0.70	 D0008A 57 mm ²
2.	C1_S1	MuRata	GRM1555C1E471JA01D Series= C0G/NP0	Cap= 470.0 pF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm ²
3.	C2_S1	Samsung Electro-Mechanics	CL10C241JB8NNNC Series= C0G/NP0	Cap= 240.0 pF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm ²
4.	R1_S1	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
5.	R2_S1	Vishay-Dale	CRCW04026K19FKED Series= CRCW..e3	Res= 6.19 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

Filter Stage :2

Cutoff Frequency 26.652 kHz
Min GBW Req'd 4.091 MHz
Stage Gain 1.0 V/V
Stage Q 1.535
Stage Topology Sallen_Key

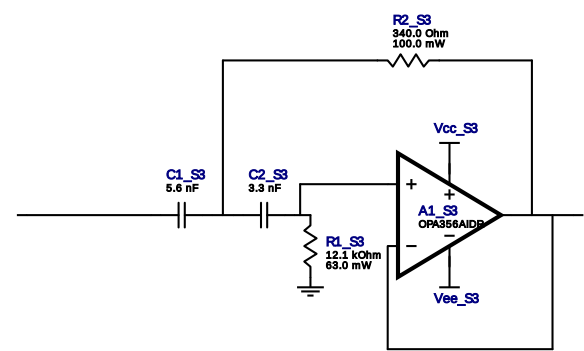


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S2	Texas Instruments, Inc.	OPA356AIDR	GbwTyp= 450.0MHz VccMin= 2.5 V VccMax= 5.5 V	1	\$0.70	 D0008A 57 mm²
2.	C1_S2	MuRata	GRM1885C1H202JA01D Series= C0G/NP0	Cap= 2.0 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm²
3.	C2_S2	Samsung Electro-Mechanics	CL10C122JB8NNNC Series= C0G/NP0	Cap= 1.2 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm²
4.	R1_S2	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
5.	R2_S2	Vishay-Dale	CRCW04021K21FKED Series= CRCW..e3	Res= 1.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²

Filter Stage :3

Cutoff Frequency 17.827 kHz
Min GBW Req'd 5.154 MHz
Stage Gain 1.0 V/V
Stage Q 2.891
Stage Topology Sallen_Key

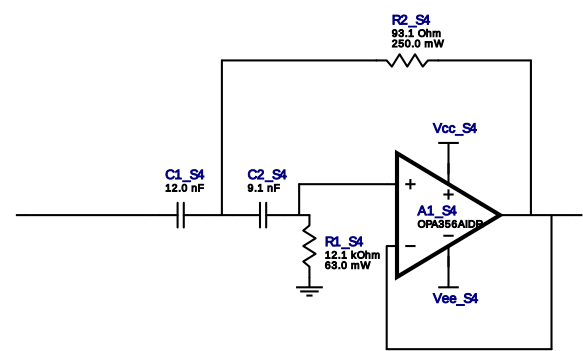


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S3	Texas Instruments, Inc.	OPA356AIDR	GbwTyp= 450.0MHz VccMin= 2.5 V VccMax= 5.5 V	1	\$0.70	 D0008A 57 mm²
2.	C1_S3	TDK	C1608C0G1E562J080AA Series= C0G/NP0	Cap= 5.6 nF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.06	 0603 5 mm²
3.	C2_S3	MuRata	GRM1885C1H332JA01D Series= C0G/NP0	Cap= 3.3 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm²
4.	R1_S3	Vishay-Dale	CRCW040212K1FKED Series= CRCW..e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
5.	R2_S3	Vishay-Dale	CRCW0603340RFKEA Series= CRCW..e3	Res= 340.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm²

Filter Stage :4

Cutoff Frequency 14.306 kHz
Min GBW Req'd 8.027 MHz
Stage Gain 1.0 V/V
Stage Q 5.611
Stage Topology Sallen_Key

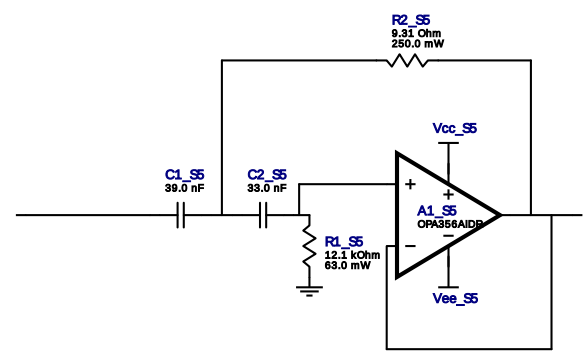


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S4	Texas Instruments, Inc.	OPA356AIDR	GbwTyp= 450.0MHz VccMin= 2.5 V VccMax= 5.5 V	1	\$0.70	 D0008A 57 mm ²
2.	C1_S4	AVX	06033C123JAT2A Series= X7R	Cap= 12.0 nF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.06	 0603 5 mm ²
3.	C2_S4	MuRata	GRM2195C1H912JA01D Series= C0G/NP0	Cap= 9.1 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.06	 0805 7 mm ²
4.	R1_S4	Vishay-Dale	CRCW040212K1FKED Series= CRCW...e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
5.	R2_S4	Panasonic	ERJ-8ENF93R1V Series= ERJ-8E	Res= 93.1 Ohm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²

Filter Stage :5

Cutoff Frequency 12.953 kHz
Min GBW Req'd 23.298 MHz
Stage Gain 1.0 V/V
Stage Q 17.987
Stage Topology Sallen_Key



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S5	Texas Instruments, Inc.	OPA356AIDR	GbwTyp= 450.0MHz VccMin= 2.5 V VccMax= 5.5 V	1	\$0.70	 D0008A 57 mm ²
2.	C1_S5	AVX	12065A392JAT2A Series= C0G/NP0	Cap= 39.0 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.09	 1206 11 mm ²
3.	C2_S5	AVX	08053A332JAT2A Series= C0G/NP0	Cap= 33.0 nF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.06	 0805 7 mm ²
4.	R1_S5	Vishay-Dale	CRCW040212K1FKED Series= CRCW...e3	Res= 12.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
5.	R2_S5	Vishay-Dale	CRCW12069R31FKEA Series= CRCW..e3	Res= 9.31 Ohm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²

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