













### My Comments

No comments

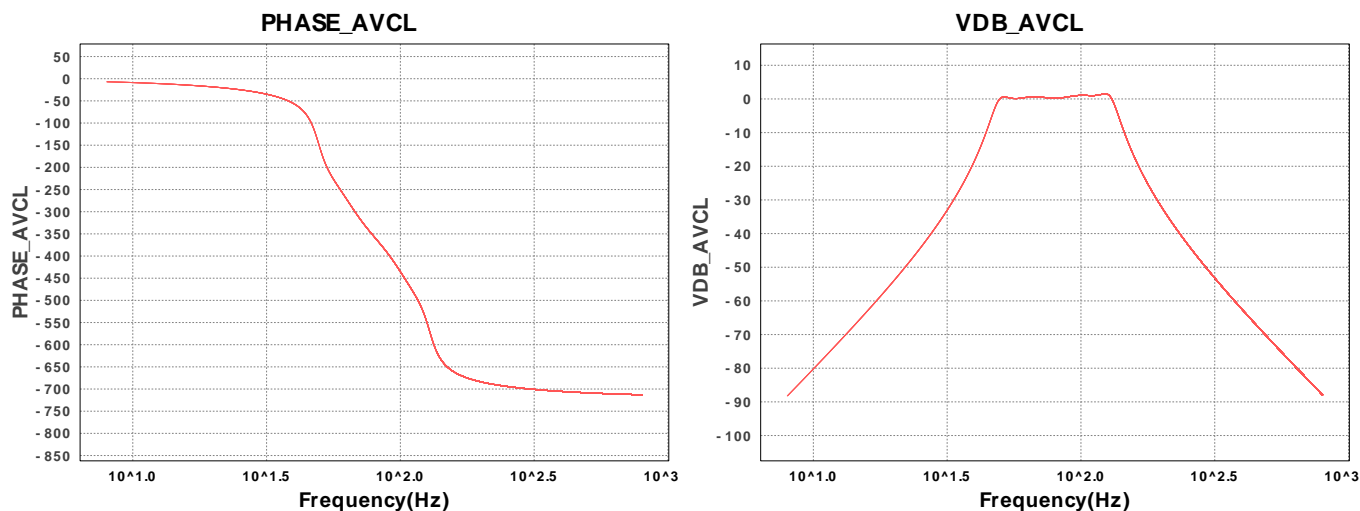
### Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S1	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0 MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm <sup>2</sup>
2.	A1_S2	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0 MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm <sup>2</sup>
3.	A1_S3	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0 MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm <sup>2</sup>
4.	A1_S4	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0 MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm <sup>2</sup>
5.	C1_S1	CUSTOM	CUSTOM Series= ?	Cap= 1.0 µF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
6.	C1_S2	CUSTOM	CUSTOM Series= ?	Cap= 1.0 µF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
7.	C1_S3	CUSTOM	CUSTOM Series= ?	Cap= 1.0 µF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
8.	C1_S4	CUSTOM	CUSTOM Series= ?	Cap= 1.0 µF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
9.	C2_S1	CUSTOM	CUSTOM Series= ?	Cap= 1.0 µF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
10.	C2_S2	CUSTOM	CUSTOM Series= ?	Cap= 1.0 µF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	C2_S3	CUSTOM	CUSTOM Series= ?	Cap= 1.0 $\mu$ F VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
12.	C2_S4	CUSTOM	CUSTOM Series= ?	Cap= 1.0 $\mu$ F VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
13.	R1_S1	Yageo	RC1206FR-074K12L Series= ?	Res= 4.12 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>
14.	R1_S2	Yageo	RC1206FR-072K67L Series= ?	Res= 2.67 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>
15.	R1_S3	Panasonic	ERJ-8ENF3091V Series= ERJ-8E	Res= 3.09 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>
16.	R1_S4	Panasonic	ERJ-8ENF1211V Series= ERJ-8E	Res= 1.21 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>
17.	R2_S1	Vishay-Dale	CRCW040211K8FKED Series= CRCW..e3	Res= 11.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
18.	R2_S2	Yageo	RC1206FR-077K68L Series= ?	Res= 7.68 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>
19.	R2_S3	Vishay-Dale	CRCW080541K2FKEA Series= CRCW..e3	Res= 41.2 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>
20.	R2_S4	Vishay-Dale	CRCW060315K8FKEA Series= CRCW..e3	Res= 15.8 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm <sup>2</sup>
21.	R3_S1	Vishay-Dale	CRCW1206576RFKEA Series= CRCW..e3	Res= 576.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>
22.	R3_S2	Vishay-Dale	CRCW0805374RFKEA Series= CRCW..e3	Res= 374.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>
23.	R3_S3	Vishay-Dale	CRCW0805274RFKEA Series= CRCW..e3	Res= 274.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>
24.	R3_S4	Vishay-Dale	CRCW1206105RFKEA Series= CRCW..e3	Res= 105.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>

## Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Vsignal	AC DC	AC Voltage Source Amplitude AC Voltage Source DC Offset	1 V 2.5 V
2.	V+	V	Vcc Supply Rail Value	5.0 V
3.	Vcm	V	Vcm Supply Rail Value	2.5 V



## Design Inputs

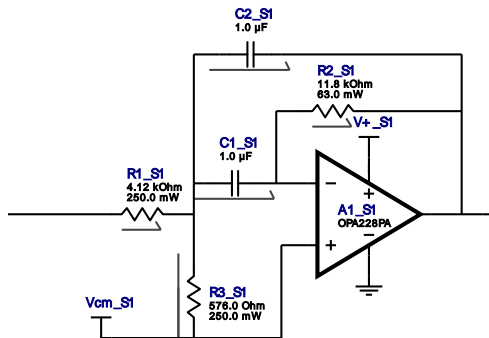
#	Name	Value	Description
1.	FilterType	Bandpass	
2.	FilterResponse	Chebyshev_05dB	
3.	FilterOrder	8.0	
4.	FilterTopology	Multiple_Feedback	
5.	NumberOfStages	4.0	
6.	CenterFrequency	80.0 Hz	
7.	StopbandAttenuation	-45.0 dB	
8.	PassbandBandwidth	80.0 Hz	
9.	StopbandBandwidth	400.0 Hz	
10.	Gain	1.0 V/V	
11.	SingleSupply	5.0 V	Power supply(s) to active chips
12.	ResistorTolerance	E96	Resistor series - 1% Passive resistor tolerance
13.	CapacitorTolerance	E24	Capacitor series - 5% Passive capacitance tolerance
14.	SeedCapacitance	1.0 $\mu$ F	Seed Capacitance to start design of filter

## Design Assistance

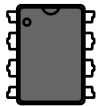



1. **OPA228PA** Product Folder : <http://www.ti.com/product/OPA228> : contains the data sheet and other resources.

## Filter Stage :1

Cutoff Frequency 64.62 Hz  
 Min GBW Req'd 15.612 kHz  
 Stage Gain 1.0 V/V  
 Stage Q 2.416  
 Stage Topology Multiple\_Feedback

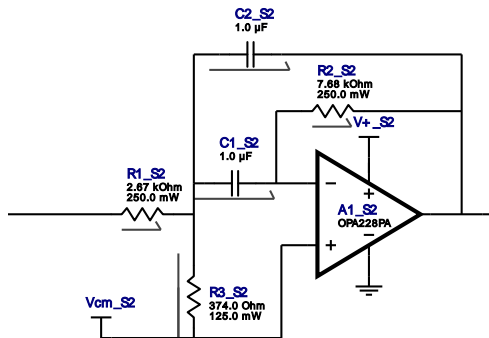


## Electrical BOM

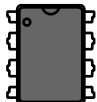



#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S1	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0 MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm <sup>2</sup>
2.	C1_S1	CUSTOM	CUSTOM Series= ?	Cap= 1.0 uF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
3.	C2_S1	CUSTOM	CUSTOM Series= ?	Cap= 1.0 uF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
4.	R1_S1	Yageo	RC1206FR-074K12L Series= ?	Res= 4.12 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>
5.	R2_S1	Vishay-Dale	CRCW040211K8FKED Series= CRCW..e3	Res= 11.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
6.	R3_S1	Vishay-Dale	CRCW1206576RFKEA Series= CRCW..e3	Res= 576.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>

## Filter Stage :2

Cutoff Frequency	99.041 Hz
Min GBW Req'd	23.928 kHz
Stage Gain	1.0 V/V
Stage Q	2.416
Stage Topology	Multiple_Feedback

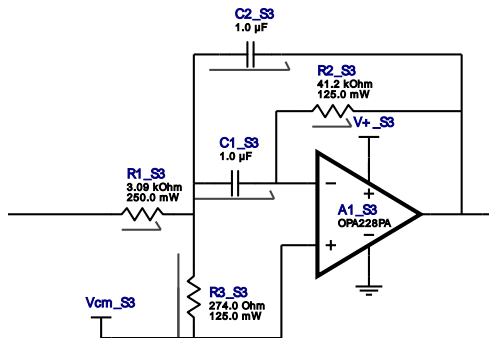


## Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S2	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0 MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm <sup>2</sup>
2.	C1_S2	CUSTOM	CUSTOM Series= ?	Cap= 1.0 uF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
3.	C2_S2	CUSTOM	CUSTOM Series= ?	Cap= 1.0 uF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
4.	R1_S2	Yageo	RC1206FR-072K67L Series= ?	Res= 2.67 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>
5.	R2_S2	Yageo	RC1206FR-077K68L Series= ?	Res= 7.68 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>
6.	R3_S2	Vishay-Dale	CRCW0805374RFKEA Series= CRCW..e3	Res= 374.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>

## Filter Stage :3

Cutoff Frequency	49.017 Hz
Min GBW Req'd	31.376 kHz
Stage Gain	1.0 V/V
Stage Q	6.401
Stage Topology	Multiple_Feedback

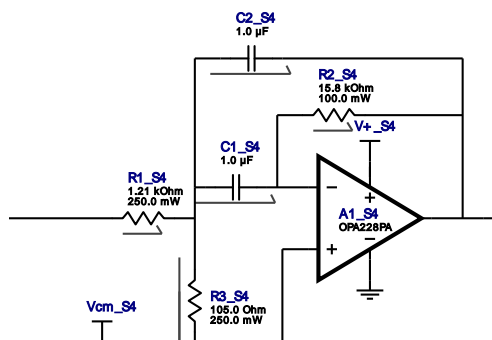


## Electrical BOM

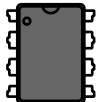


#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S3	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0 MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm <sup>2</sup>
2.	C1_S3	CUSTOM	CUSTOM Series= ?	Cap= 1.0 uF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
3.	C2_S3	CUSTOM	CUSTOM Series= ?	Cap= 1.0 uF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
4.	R1_S3	Panasonic	ERJ-8ENF3091V Series= ERJ-8E	Res= 3.09 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>
5.	R2_S3	Vishay-Dale	CRCW080541K2FKEA Series= CRCW..e3	Res= 41.2 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>
6.	R3_S3	Vishay-Dale	CRCW0805274RFKEA Series= CRCW..e3	Res= 274.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>


## Filter Stage :4

Cutoff Frequency 130.567 Hz  
 Min GBW Req'd 83.576 kHz  
 Stage Gain 1.0 V/V  
 Stage Q 6.401  
 Stage Topology Multiple\_Feedback



### Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S4	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0 MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm <sup>2</sup>
2.	C1_S4	CUSTOM	CUSTOM Series= ?	Cap= 1.0 uF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
3.	C2_S4	CUSTOM	CUSTOM Series= ?	Cap= 1.0 uF VDC= 0.0 V IRMS= 0.0 A	1	NA	CUSTOM 0 mm <sup>2</sup>
4.	R1_S4	Panasonic	ERJ-8ENF1211V Series= ERJ-8E	Res= 1.21 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>
5.	R2_S4	Vishay-Dale	CRCW060315K8FKEA Series= CRCW..e3	Res= 15.8 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm <sup>2</sup>

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
6.	R3_S4	Vishay-Dale	CRCW1206105RFKEA Series= CRCW..e3	Res= 105.0 Ohm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm <sup>2</sup>

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