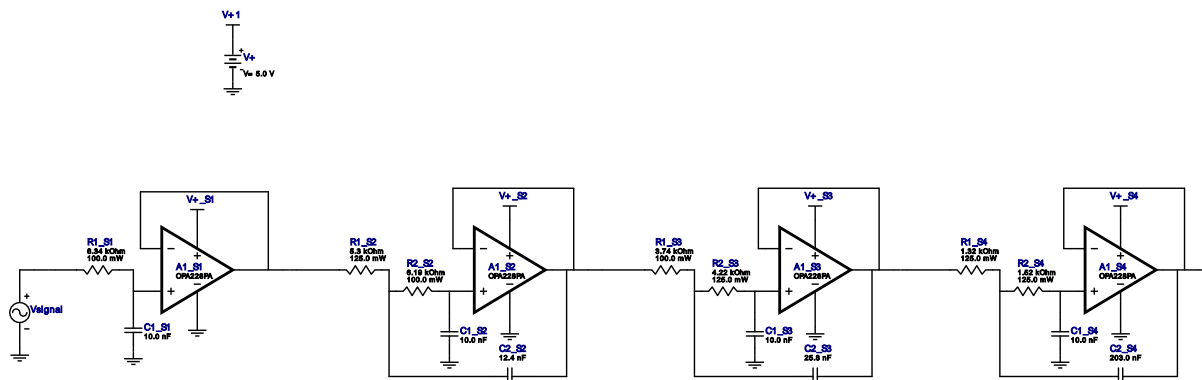


WEBENCH® Design Report

Design : 5322186/2 OPA228PA
Lowpass, Sallen_Key, Butterworth



My Comments

No comments

Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S1	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm ²
2.	A1_S2	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm ²
3.	A1_S3	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm ²
4.	A1_S4	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm ²
5.	C1_S1	CUSTOM	CUSTOM Series= ?	Cap= 10.0 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm ²
6.	C1_S2	CUSTOM	CUSTOM Series= ?	Cap= 10.0 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm ²
7.	C1_S3	CUSTOM	CUSTOM Series= ?	Cap= 10.0 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm ²
8.	C1_S4	CUSTOM	CUSTOM Series= ?	Cap= 10.0 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm ²
9.	C2_S2	CUSTOM	CUSTOM Series= ?	Cap= 12.4 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	C2_S3	CUSTOM	CUSTOM Series= ?	Cap= 25.8 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm ²
11.	C2_S4	CUSTOM	CUSTOM Series= ?	Cap= 203.0 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm ²
12.	R1_S1	Yageo America	RT0603DRE076K34L Series= ?	Res= 6.34 kOhm Power= 100.0 mW Tolerance= 0.5%	1	\$0.01	 0603 5 mm ²
13.	R1_S2	Yageo America	RT0805BRD075K3L Series= RT0805	Res= 5.3 kOhm Power= 125.0 mW Tolerance= 0.1%	1	NA	 0805 7 mm ²
14.	R1_S3	Susumu Co Ltd	RR1220P-3741-D-M Series= RR12	Res= 3.74 kOhm Power= 100.0 mW Tolerance= 0.5%	1	\$0.01	 0805 7 mm ²
15.	R1_S4	Yageo America	RT0805BRD071K32L Series= RT0805	Res= 1.32 kOhm Power= 125.0 mW Tolerance= 0.1%	1	NA	 0805 7 mm ²
16.	R2_S2	Susumu Co Ltd	RR1220P-6191-D-M Series= RR12	Res= 6.19 kOhm Power= 100.0 mW Tolerance= 0.5%	1	\$0.01	 0805 7 mm ²
17.	R2_S3	Yageo America	RT0805BRD074K22L Series= ?	Res= 4.22 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.04	 0805 7 mm ²
18.	R2_S4	Yageo America	RT0805BRD071K52L Series= RT0805	Res= 1.52 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.04	 0805 7 mm ²

Design Inputs

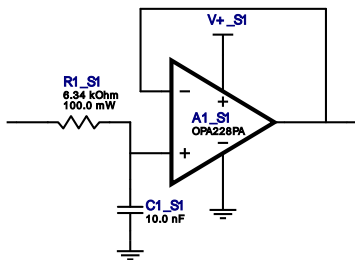
#	Name	Value	Description
1.	FilterType	Lowpass	
2.	FilterResponse	Butterworth	
3.	FilterOrder	7.0	
4.	FilterTopology	Sallen_Key	
5.	NumberOfStages	0.0	
6.	PassbandFrequency	2.5 k	
7.	StopbandAttenuation	-40.0	
8.	StopbandFrequency	5.0 k	
9.	Gain	1.0	
10.	SingleSupply	5.0	Power supply(s) to active chips
11.	ResistorTolerance	E192	Resistor series - 0.5% Passive resistor tolerance
12.	CapacitorTolerance	E192	Capacitor series - 0.5% Passive capacitance tolerance
13.	SeedCapacitance	10.0 n	Seed Capacitance to start design of filter

Design Assistance

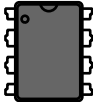

1. **OPA228PA** Product Folder : <http://www.ti.com//product/OPA228> : contains the data sheet and other resources.

Filter Stage :1

Cutoff Frequency 2.5 kHz
Min GBW Req'd 125.0 kHz
Stage Gain 1.0 V/V
Stage Q 500.0 m
Stage Topology Sallen_Key

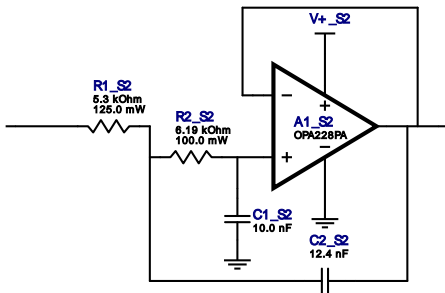


Electrical BOM

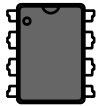


#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S1	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm²
2.	C1_S1	CUSTOM	CUSTOM Series= ?	Cap= 10.0 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm²
3.	R1_S1	Yageo America	RT0603DRE076K34L Series= ?	Res= 6.34 kOhm Power= 100.0 mW Tolerance= 0.5%	1	\$0.01	 0603 5 mm²

Filter Stage :2

Cutoff Frequency 2.5 kHz
 Min GBW Req'd 138.744 kHz
 Stage Gain 1.0 V/V
 Stage Q 554.958 m
 Stage Topology Sallen_Key

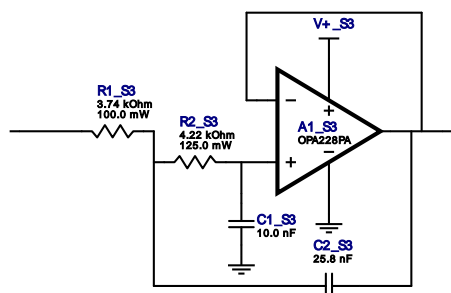


Electrical BOM

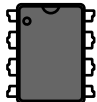


#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S2	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm ²
2.	C1_S2	CUSTOM	CUSTOM Series= ?	Cap= 10.0 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm ²
3.	C2_S2	CUSTOM	CUSTOM Series= ?	Cap= 12.4 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm ²
4.	R1_S2	Yageo America	RT0805BRD075K3L Series= RT0805	Res= 5.3 kOhm Power= 125.0 mW Tolerance= 0.1%	1	NA	 0805 7 mm ²
5.	R2_S2	Susumu Co Ltd	RR1220P-6191-D-M Series= RR12	Res= 6.19 kOhm Power= 100.0 mW Tolerance= 0.5%	1	\$0.01	 0805 7 mm ²

Filter Stage :3

Cutoff Frequency 2.5 kHz
 Min GBW Req'd 200.474 kHz
 Stage Gain 1.0 V/V
 Stage Q 801.91 m
 Stage Topology Sallen_Key

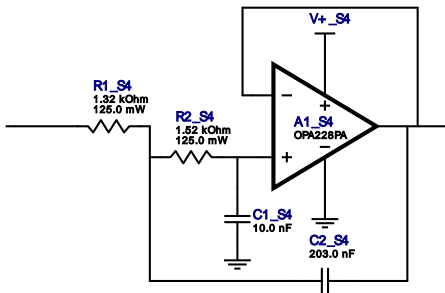


Electrical BOM

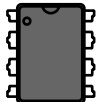


#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S3	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm ²
2.	C1_S3	CUSTOM	CUSTOM Series= ?	Cap= 10.0 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm ²
3.	C2_S3	CUSTOM	CUSTOM Series= ?	Cap= 25.8 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm ²
4.	R1_S3	Susumu Co Ltd	RR1220P-3741-D-M Series= RR12	Res= 3.74 kOhm Power= 100.0 mW Tolerance= 0.5%	1	\$0.01	 0805 7 mm ²
5.	R2_S3	Yageo America	RT0805BRD074K22L Series= ?	Res= 4.22 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.04	 0805 7 mm ²

Filter Stage :4

Cutoff Frequency 2.5 kHz
 Min GBW Req'd 561.762 kHz
 Stage Gain 1.0 V/V
 Stage Q 2.247
 Stage Topology Sallen_Key



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S4	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0MHz VccMin= 5.0 V VccMax= 36.0 V	1	\$1.42	 P0008A 116 mm ²
2.	C1_S4	CUSTOM	CUSTOM Series= ?	Cap= 10.0 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm ²
3.	C2_S4	CUSTOM	CUSTOM Series= ?	Cap= 203.0 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm ²
4.	R1_S4	Yageo America	RT0805BRD071K32L Series= RT0805	Res= 1.32 kOhm Power= 125.0 mW Tolerance= 0.1%	1	NA	 0805 7 mm ²
5.	R2_S4	Yageo America	RT0805BRD071K52L Series= RT0805	Res= 1.52 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.04	 0805 7 mm ²

Texas Instruments' WEBENCH simulation tools attempt to recreate the performance of a substantially equivalent physical implementation of the design. Simulations are created using Texas Instruments' published specifications as well as the published specifications of other device manufacturers. While Texas Instruments does update this information periodically, this information may not be current at the time the simulation is built. Texas Instruments does not warrant the accuracy or completeness of the specifications or any information contained therein. Texas Instruments does not warrant that any designs or recommended parts will meet the specifications you entered, will be suitable for your application or fit for any particular purpose, or will operate as shown in the simulation in a physical implementation. Texas Instruments does not warrant that the designs are production worthy.

You should completely validate and test your design implementation to confirm the system functionality for your application prior to production.

Use of Texas Instruments' WEBENCH simulation tools is subject to [Texas Instruments' Site Terms and Conditions of Use](#). Prototype boards based on WEBENCH created designs are provided AS IS without warranty of any kind for evaluation and testing purposes and are subject to the terms of the [Evaluation License Agreement](#).