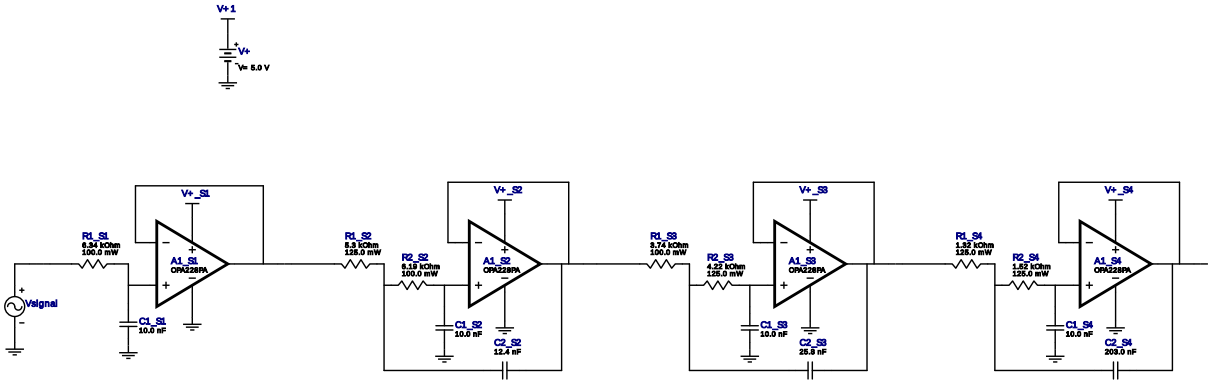
Type : Lowpass
Response : Butterworth
Order : 7
Number of Stages : 0

Device = OPA228PA
Created = May 03 2018 10:15AM

WEBENCH® Design Report

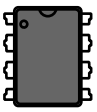
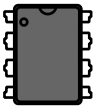
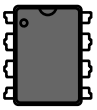
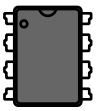
Design : 5322186/2 OPA228PA
Lowpass, Sallen_Key, Butterworth



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

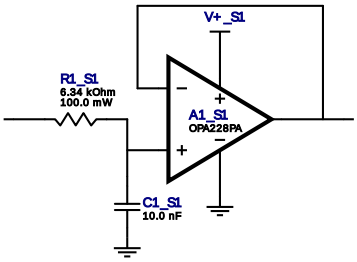
#	Name	Value	Description
1.	FilterType	Lowpass	
2.	FilterResponse	Butterworth	
3.	FilterOrder	7.0	
4.	FilterTopology	Sallen_Key	
5.	NumberOfStages	0.0	
6.	PassbandFrequency	2.5 k	
7.	StopbandAttenuation	-40.0	
8.	StopbandFrequency	5.0 k	
9.	Gain	1.0	
10.	SingleSupply	5.0	Power supply(s) to active chips
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

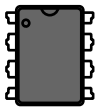
1. **OPA228PA** Product Folder : http://www.ti.com//product/OPA228 : contains the data sheet and other resources.

Filter Stage :1

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

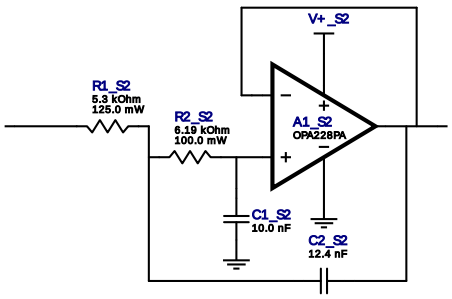


Electrical BOM

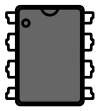
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S1	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0MHz VccMin= 5.0 V VccMax= 36.0 V	1	$1.42	 P0008A 116 mm^2
2.	C1_S1	CUSTOM	CUSTOM Series= ?	Cap= 10.0 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm^2
3.	R1_S1	Yageo America	RT0603DRE076K34L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

Filter Stage :2

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

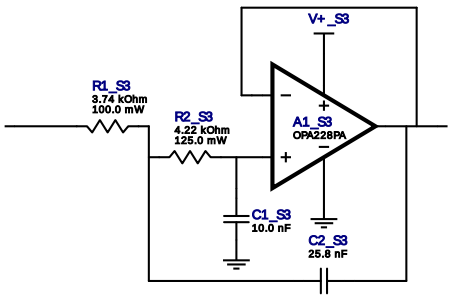


Electrical BOM

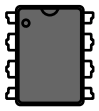
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S2	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0MHz VccMin= 5.0 V VccMax= 36.0 V	1	$1.42	 P0008A 116 mm^2
2.	C1_S2	CUSTOM	CUSTOM Series= ?	Cap= 10.0 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm^2
3.	C2_S2	CUSTOM	CUSTOM Series= ?	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 Reqd	200.474 kHz
Stage Gain	1.0 V/V
Stage Q	801.91 m
Stage Topology	Sallen_Key

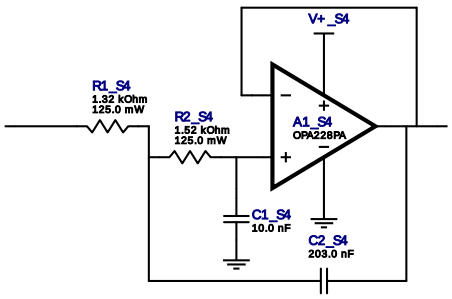


Electrical BOM

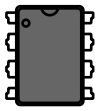
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S3	Texas Instruments, Inc.	OPA228PA	GbwTyp= 33.0MHz VccMin= 5.0 V VccMax= 36.0 V	1	$1.42	 P0008A 116 mm^2
2.	C1_S3	CUSTOM	CUSTOM Series= ?	Cap= 10.0 nF VDC= 0.0 V Tolerance= 0.0 %	1	NA	CUSTOM 0 mm^2
3.	C2_S3	CUSTOM	CUSTOM Series= ?	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 Reqd	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