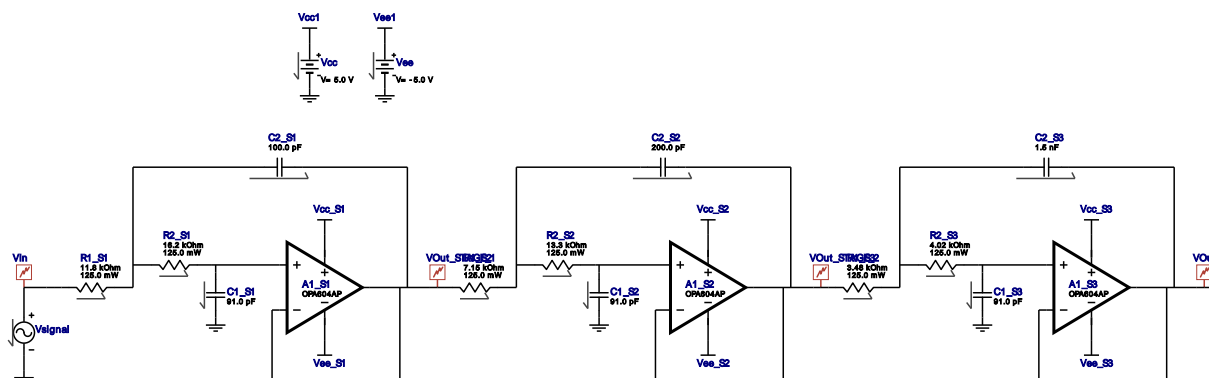


WEBENCH® Electrical Simulation Report



Type : Lowpass
Response : Butterworth
Topology : Sallen_Key
Order : 6
Stage Qty : 3

Device = OPA604AP
Topology = Custom LP Filter
Created = 2/9/15 4:36:07 AM
User ID = 1198965
Design Id = 11
eSim Id = 1
Simulation Type = Closed Loop Freq
Response



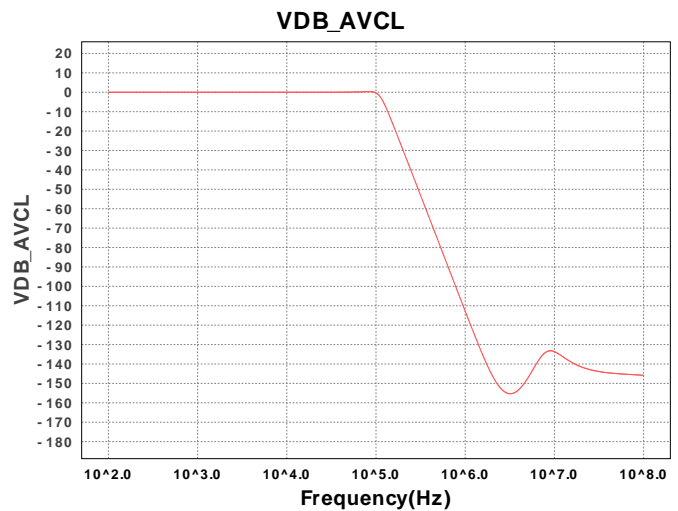
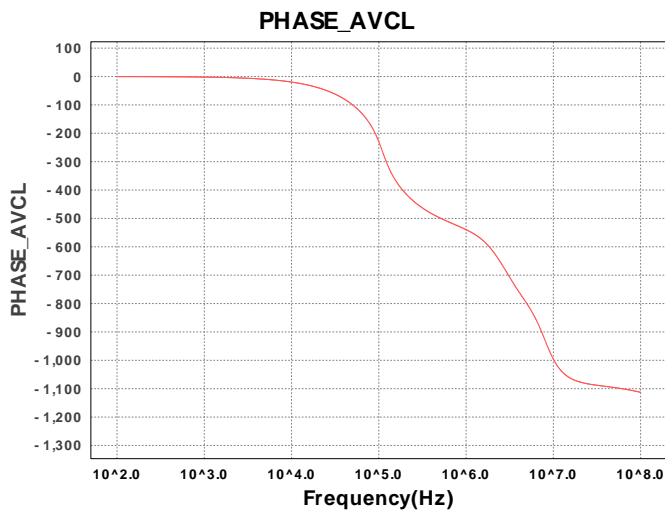
Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S1	Texas Instruments	OPA604AP	GbwTyp= 20.0 MHz VccMin= 9.0 V VccMax= 48.0 V	1	\$1.05	DIP 0 mm ²
2.	A1_S2	Texas Instruments	OPA604AP	GbwTyp= 20.0 MHz VccMin= 9.0 V VccMax= 48.0 V	1	\$1.05	DIP 0 mm ²
3.	A1_S3	Texas Instruments	OPA604AP	GbwTyp= 20.0 MHz VccMin= 9.0 V VccMax= 48.0 V	1	\$1.05	DIP 0 mm ²
4.	C1_S1	Samsung Electro-Mechanics	CL05C910JB5NCNC Series= C0G	Cap= 91.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
5.	C1_S2	Samsung Electro-Mechanics	CL05C910JB5NCNC Series= C0G	Cap= 91.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
6.	C1_S3	Samsung Electro-Mechanics	CL05C910JB5NCNC Series= C0G	Cap= 91.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
7.	C2_S1	Kemet	C0402C101J5GACTU Series= C0G	Cap= 100.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
8.	C2_S2	Samsung Electro-Mechanics	CL05C201JB5NNNC Series= C0G	Cap= 200.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
9.	C2_S3	AVX	04025A151JAT2A Series= C0G	Cap= 1.5 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.02	0402 3 mm ²
10.	R1_S1	Panasonic	ERJ-6ENF1182V Series= 225	Res= 11.8 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
11.	R1_S2	Panasonic	ERJ-6ENF7151V Series= 225	Res= 7.15 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
12.	R1_S3	Panasonic	ERJ-6ENF3481V Series= 225	Res= 3.48 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
13.	R2_S1	Panasonic	ERJ-6ENF1622V Series= 225	Res= 16.2 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
14.	R2_S2	Panasonic	ERJ-6ENF1332V Series= 225	Res= 13.3 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²
15.	R2_S3	Panasonic	ERJ-6ENF4021V Series= 225	Res= 4.02 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm ²

Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Vsignal	AC DC	AC Voltage Source Amplitude AC Voltage Source DC Offset	1 V 0.0 V
2.	Vcc	V	Vcc Supply Rail Value	5.0 V
3.	Vee	V	Vee Supply Rail Value	-5.0 V



Design Inputs

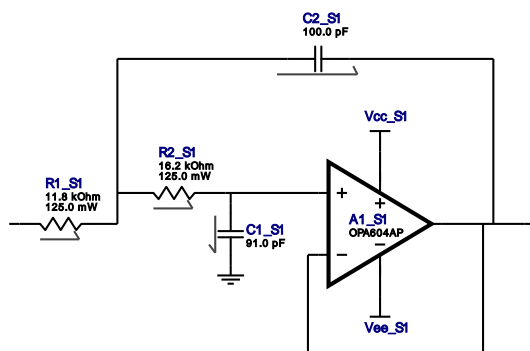
#	Name	Value	Description
1.	CapacitorTolerance	E24	Capacitor series - 5 Passive capacitance tolerance
2.	DualSupply	+/-5.0 V	Power supply(s) to active chips
3.	FilterOrder	6.0	
4.	FilterResponse	Butterworth	
5.	FilterTopology	Sallen_Key	
6.	FilterType	Lowpass	
7.	Gain	1.0 V/V	
8.	NumberOfStages	3.0	
9.	PassbandFrequency	100.0 kHz	
10.	ResistorTolerance	E96	Resistor series - 1% Passive resistor tolerance
11.	SeedCapacitance	100.0 pF	Seed Capacitance to start design of filter
12.	SettlingTimeErrorBand	100.0 m%	Settling Time Error Band
13.	SettlingTimeSpecification	100.0 µsec	Settling Time Specification
14.	StepResponseOvershootSpec	20.0 %	Step Response Overshoot
15.	StopbandAttenuation	-100.0 dB	
16.	StopbandFrequency	1000.0 kHz	

Design Assistance

1. **OPA604AP** Product Folder : <http://www.ti.com//product/OPA604> : contains the data sheet and other resources.

Filter Stage :1

Cutoff Frequency 100.0 kHz
 Gain Bandwidth 5.2 MHz
 Stage Gain 1.0 V/V
 Stage Q 520.0 m
 Stage Topology Sallen_Key
 StageNo 1.0

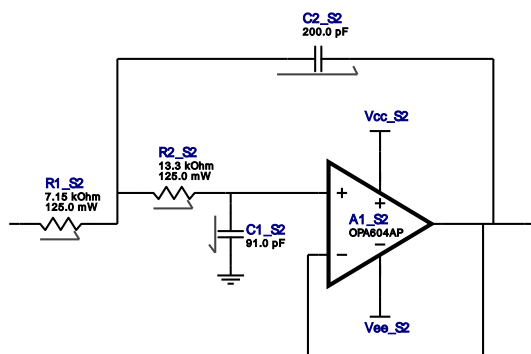


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S1	Texas Instruments	OPA604AP	GbwTyp= 20.0 MHz VccMin= 9.0 V VccMax= 48.0 V	1	\$1.05	DIP 0 mm ²
2.	C1_S1	Samsung Electro-Mechanics	CL05C910JB5NCNC Series= C0G	Cap= 91.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
3.	C2_S1	Kemet	C0402C101J5GACTU Series= C0G	Cap= 100.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
4.	R1_S1	Panasonic	ERJ-6ENF1182V Series= 225	Res= 11.8 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
5.	R2_S1	Panasonic	ERJ-6ENF1622V Series= 225	Res= 16.2 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²

Filter Stage :2

Cutoff Frequency 100.0 kHz
 Gain Bandwidth 7.1 MHz
 Stage Gain 1.0 V/V
 Stage Q 710.0 m
 Stage Topology Sallen_Key
 StageNo 2.0

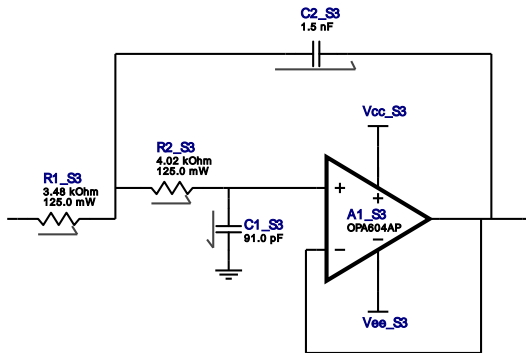


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S2	Texas Instruments	OPA604AP	GbwTyp= 20.0 MHz VccMin= 9.0 V VccMax= 48.0 V	1	\$1.05	DIP 0 mm ²
2.	C1_S2	Samsung Electro-Mechanics	CL05C910JB5NCNC Series= C0G	Cap= 91.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
3.	C2_S2	Samsung Electro-Mechanics	CL05C201JB5NNNC Series= C0G	Cap= 200.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
4.	R1_S2	Panasonic	ERJ-6ENF7151V Series= 225	Res= 7.15 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
5.	R2_S2	Panasonic	ERJ-6ENF1332V Series= 225	Res= 13.3 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²

Filter Stage :3

Cutoff Frequency 100.0 kHz
 Gain Bandwidth 19.3 MHz
 Stage Gain 1.0 V/V
 Stage Q 1.93
 Stage Topology Sallen_Key
 StageNo 3.0



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S3	Texas Instruments	OPA604AP	GbwTyp= 20.0 MHz VccMin= 9.0 V VccMax= 48.0 V	1	\$1.05	DIP 0 mm ²
2.	C1_S3	Samsung Electro-Mechanics	CL05C910JB5NCNC Series= C0G	Cap= 91.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
3.	C2_S3	AVX	04025A151JAT2A Series= C0G	Cap= 1.5 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.02	0402 3 mm ²
4.	R1_S3	Panasonic	ERJ-6ENF3481V Series= 225	Res= 3.48 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
5.	R2_S3	Panasonic	ERJ-6ENF4021V Series= 225	Res= 4.02 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²

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