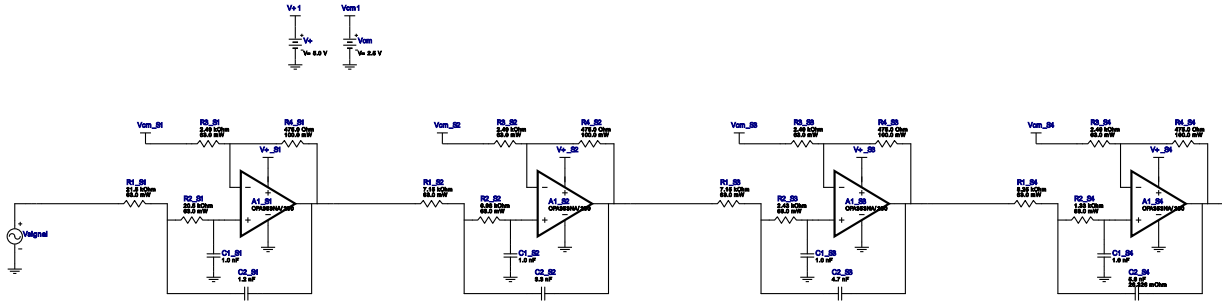















WEBENCH[®] Design Report

 Design : 4410947/4 OPA353NA/250
 Lowpass, Sallen Key, Chebyshev 0.2 dB

Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S1	Texas Instruments	OPA353NA/250	GbwTyp= 44.0 MHz VccMin= 2.7 V VccMax= 5.5 V	1	\$1.15	 SOT-23 14 mm ²
2.	A1_S2	Texas Instruments	OPA353NA/250	GbwTyp= 44.0 MHz VccMin= 2.7 V VccMax= 5.5 V	1	\$1.15	 SOT-23 14 mm ²
3.	A1_S3	Texas Instruments	OPA353NA/250	GbwTyp= 44.0 MHz VccMin= 2.7 V VccMax= 5.5 V	1	\$1.15	 SOT-23 14 mm ²
4.	A1_S4	Texas Instruments	OPA353NA/250	GbwTyp= 44.0 MHz VccMin= 2.7 V VccMax= 5.5 V	1	\$1.15	 SOT-23 14 mm ²
5.	C1_S1	Samsung Electro-Mechanics	CL05C102JO5NNNC Series= C0G/NP0	Cap= 1.0 nF VDC= 16.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm ²
6.	C1_S2	Samsung Electro-Mechanics	CL05C102JO5NNNC Series= C0G/NP0	Cap= 1.0 nF VDC= 16.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm ²
7.	C1_S3	Samsung Electro-Mechanics	CL05C102JO5NNNC Series= C0G/NP0	Cap= 1.0 nF VDC= 16.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm ²
8.	C1_S4	Samsung Electro-Mechanics	CL05C102JO5NNNC Series= C0G/NP0	Cap= 1.0 nF VDC= 16.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm ²
9.	C2_S1	MuRata	GRM1885C1E122JA01D Series= C0G/NP0	Cap= 1.2 nF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.02	 0603 5 mm ²
10.	C2_S2	TDK	CGA3E2C0G1H332J080AA Series= C0G/NP0	Cap= 3.3 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.02	 0603 5 mm ²
11.	C2_S3	Kemet	C0603C472J5RACTU Series= X7R	Cap= 4.7 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm ²
12.	C2_S4	TDK	C1608C0G1E562J Series= C0G/NP0	Cap= 5.6 nF ESR= 26.326 mOhm VDC= 25.0 V Tolerance= 5.0 %	1	\$0.06	 0603 5 mm ²
13.	R1_S1	Vishay-Dale	CRCW040221K5FKED Series= CRCW..e3	Res= 21.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
14.	R1_S2	Vishay-Dale	CRCW04027K15FKED Series= CRCW..e3	Res= 7.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
15.	R1_S3	Vishay-Dale	CRCW04027K15FKED Series= CRCW..e3	Res= 7.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
16.	R1_S4	Vishay-Dale	CRCW04028K25FKED Series= CRCW..e3	Res= 8.25 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
17.	R2_S1	Vishay-Dale	CRCW040220K5FKED Series= CRCW..e3	Res= 20.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
18.	R2_S2	Vishay-Dale	CRCW04026K98FKED Series= CRCW..e3	Res= 6.98 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
19.	R2_S3	Vishay-Dale	CRCW04022K43FKED Series= CRCW..e3	Res= 2.43 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
20.	R2_S4	Vishay-Dale	CRCW04021K33FKED Series= CRCW..e3	Res= 1.33 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
21.	R3_S1	Vishay-Dale	CRCW04022K49FKED Series= CRCW..e3	Res= 2.49 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
22.	R3_S2	Vishay-Dale	CRCW04022K49FKED Series= CRCW..e3	Res= 2.49 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
23.	R3_S3	Vishay-Dale	CRCW04022K49FKED Series= CRCW..e3	Res= 2.49 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
24.	R3_S4	Vishay-Dale	CRCW04022K49FKED Series= CRCW..e3	Res= 2.49 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
25.	R4_S1	Vishay-Dale	CRCW0603475RFKEA Series= CRCW..e3	Res= 475.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
26.	R4_S2	Vishay-Dale	CRCW0603475RFKEA Series= CRCW..e3	Res= 475.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
27.	R4_S3	Vishay-Dale	CRCW0603475RFKEA Series= CRCW..e3	Res= 475.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
28.	R4_S4	Vishay-Dale	CRCW0603475RFKEA Series= CRCW..e3	Res= 475.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²

Design Inputs

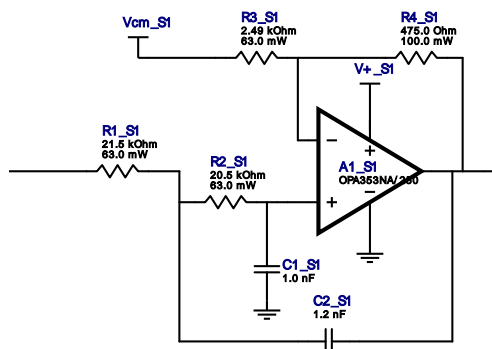
#	Name	Value	Description
1.	FilterType	Lowpass	
2.	FilterResponse	Chebyshev	
3.	FilterOrder	8.0	
4.	FilterTopology	Sallen_Key	
5.	NumberOfStages	4.0	
6.	PassbandFrequency	20.0 k	
7.	StopbandAttenuation	-45.0	
8.	StopbandFrequency	30.0 k	
9.	Gain	2.0	
10.	SingleSupply	5.0	Power supply(s) to active chips
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. OPA353NA/250 Product Folder : <http://www.ti.com/product/OPA353> : contains the data sheet and other resources.

Filter Stage :1

Cutoff Frequency 6.869 kHz
 Min GBW Req'd 505.544 kHz
 Stage Gain 1.189 V/V
 Stage Q 619.0 m
 Stage Topology Sallen_Key

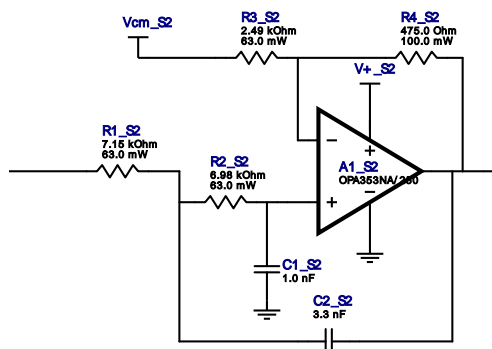


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S1	Texas Instruments	OPA353NA/250	GbwTyp= 44.0 MHz VccMin= 2.7 V VccMax= 5.5 V	1	\$1.15	 SOT-23 14 mm ²
2.	C1_S1	Samsung Electro-Mechanics	CL05C102JO5NNNC Series= C0G/NP0	Cap= 1.0 nF VDC= 16.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm ²
3.	C2_S1	MuRata	GRM1885C1E122JA01D Series= C0G/NP0	Cap= 1.2 nF VDC= 25.0 V Tolerance= 5.0 %	1	\$0.02	 0603 5 mm ²
4.	R1_S1	Vishay-Dale	CRCW040221K5FKED Series= CRCW..e3	Res= 21.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
5.	R2_S1	Vishay-Dale	CRCW040220K5FKED Series= CRCW..e3	Res= 20.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
6.	R3_S1	Vishay-Dale	CRCW04022K49FKED Series= CRCW..e3	Res= 2.49 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
7.	R4_S1	Vishay-Dale	CRCW0603475RFKEA Series= CRCW..e3	Res= 475.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²

Filter Stage :2

Cutoff Frequency 12.467 kHz
 Min GBW Req'd 1.966 MHz
 Stage Gain 1.189 V/V
 Stage Q 1.326
 Stage Topology Sallen_Key

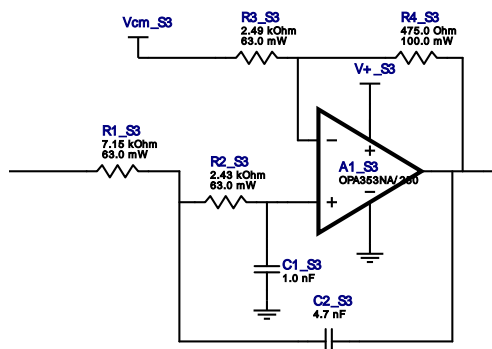


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S2	Texas Instruments	OPA353NA/250	GbwTyp= 44.0 MHz VccMin= 2.7 V VccMax= 5.5 V	1	\$1.15	 SOT-23 14 mm ²
2.	C1_S2	Samsung Electro-Mechanics	CL05C102JO5NNNC Series= C0G/NP0	Cap= 1.0 nF VDC= 16.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm ²
3.	C2_S2	TDK	CGA3E2C0G1H332J080AA Series= C0G/NP0	Cap= 3.3 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.02	 0603 5 mm ²
4.	R1_S2	Vishay-Dale	CRCW04027K15FKED Series= CRCW..e3	Res= 7.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
5.	R2_S2	Vishay-Dale	CRCW04026K98FKED Series= CRCW..e3	Res= 6.98 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
6.	R3_S2	Vishay-Dale	CRCW04022K49FKED Series= CRCW..e3	Res= 2.49 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
7.	R4_S2	Vishay-Dale	CRCW0603475RFKEA Series= CRCW..e3	Res= 475.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²

Filter Stage :3

Cutoff Frequency 17.564 kHz
 Min GBW Req'd 5.839 MHz
 Stage Gain 1.189 V/V
 Stage Q 2.796
 Stage Topology Sallen_Key

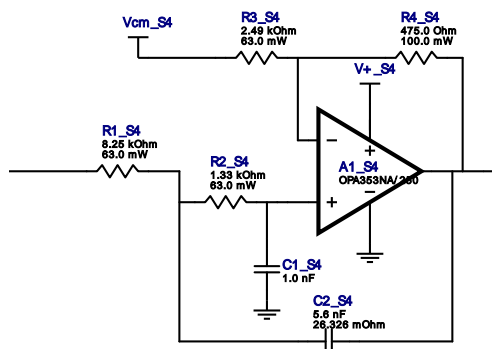


Electrical BOM





#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S3	Texas Instruments	OPA353NA/250	GbwTyp= 44.0 MHz VccMin= 2.7 V VccMax= 5.5 V	1	\$1.15	 SOT-23 14 mm ²
2.	C1_S3	Samsung Electro-Mechanics	CL05C102JO5NNNC Series= C0G/NP0	Cap= 1.0 nF VDC= 16.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm ²
3.	C2_S3	Kemet	C0603C472J5RACTU Series= X7R	Cap= 4.7 nF VDC= 50.0 V Tolerance= 5.0 %	1	\$0.01	 0603 5 mm ²
4.	R1_S3	Vishay-Dale	CRCW04027K15FKED Series= CRCW..e3	Res= 7.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
5.	R2_S3	Vishay-Dale	CRCW04022K43FKED Series= CRCW..e3	Res= 2.43 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
6.	R3_S3	Vishay-Dale	CRCW04022K49FKED Series= CRCW..e3	Res= 2.43 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
7.	R4_S3	Vishay-Dale	CRCW0603475RFKEA Series= CRCW..e3	Res= 475.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²

Filter Stage :4

Cutoff Frequency 20.414 kHz
 Min GBW Req'd 22.464 MHz
 Stage Gain 1.189 V/V
 Stage Q 9.255
 Stage Topology Sallen_Key



Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	A1_S4	Texas Instruments	OPA353NA/250	GbwTyp= 44.0 MHz VccMin= 2.7 V VccMax= 5.5 V	1	\$1.15	 SOT-23 14 mm ²
2.	C1_S4	Samsung Electro-Mechanics	CL05C102JO5NNNC Series= C0G/NP0	Cap= 1.0 nF VDC= 16.0 V Tolerance= 5.0 %	1	\$0.01	 0402 3 mm ²
3.	C2_S4	TDK	C1608C0G1E562J Series= C0G/NP0	Cap= 5.6 nF ESR= 26.326 mOhm VDC= 25.0 V Tolerance= 5.0 %	1	\$0.06	 0603 5 mm ²
4.	R1_S4	Vishay-Dale	CRCW04028K25FKED Series= CRCW..e3	Res= 8.25 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
5.	R2_S4	Vishay-Dale	CRCW04021K33FKED Series= CRCW..e3	Res= 1.33 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
6.	R3_S4	Vishay-Dale	CRCW04022K49FKED Series= CRCW..e3	Res= 2.49 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	R4_S4	Vishay-Dale	CRCW0603475RFKEA Series= CRCW..e3	Res= 475.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²

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