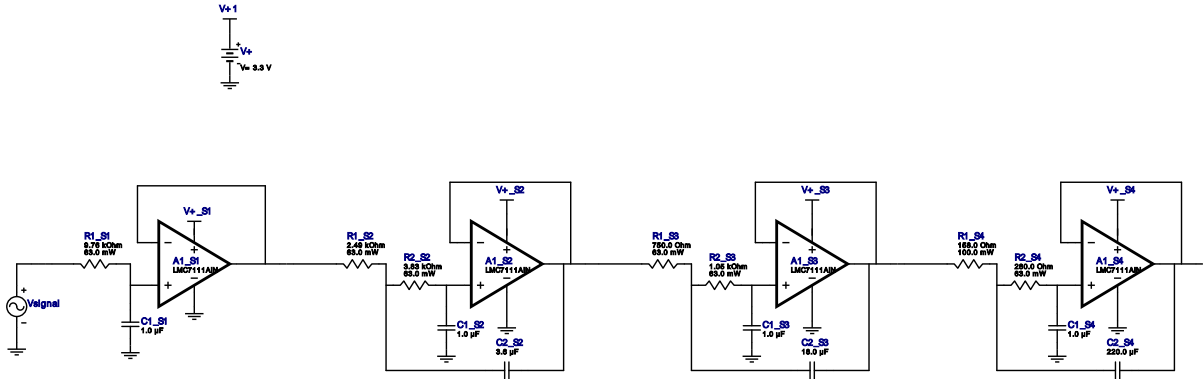


**WEBENCH® Design Report**

 Design : 4325536/6 LMC7111AIN  
 Lowpass, Sallen Key, Chebyshev 0.2 dB

**Electrical BOM**

| #   | Name  | Manufacturer      | Part Number                          | Properties   | Qty | Price  | Footprint                |
|-----|-------|-------------------|--------------------------------------|--|-----|--------|--------------------------|
| 1.  | A1_S1 | Texas Instruments | LMC7111AIN                           | GbwTyp= 50.0 mMHz<br>VccMin= 2.7 V<br>VccMax= 11.0 V | 1   | \$0.55 | DIP 0 mm <sup>2</sup>    |
| 2.  | A1_S2 | Texas Instruments | LMC7111AIN                           | GbwTyp= 50.0 mMHz<br>VccMin= 2.7 V<br>VccMax= 11.0 V | 1   | \$0.55 | DIP 0 mm <sup>2</sup>    |
| 3.  | A1_S3 | Texas Instruments | LMC7111AIN                           | GbwTyp= 50.0 mMHz<br>VccMin= 2.7 V<br>VccMax= 11.0 V | 1   | \$0.55 | DIP 0 mm <sup>2</sup>    |
| 4.  | A1_S4 | Texas Instruments | LMC7111AIN                           | GbwTyp= 50.0 mMHz<br>VccMin= 2.7 V<br>VccMax= 11.0 V | 1   | \$0.55 | DIP 0 mm <sup>2</sup>    |
| 5.  | C1_S1 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 1.0 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %        | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 6.  | C1_S2 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 1.0 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %        | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 7.  | C1_S3 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 1.0 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %        | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 8.  | C1_S4 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 1.0 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %        | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 9.  | C2_S2 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 3.6 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %        | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 10. | C2_S3 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 18.0 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %       | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 11. | C2_S4 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 220.0 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %      | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 12. | R1_S1 | Vishay-Dale       | CRCW04029K76FKED<br>Series= CRCW..e3 | Res= 9.76 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | 0402 3 mm <sup>2</sup>   |

| #   | Name  | Manufacturer | Part Number                          | Properties   | Qty | Price  | Footprint              |
|-----|-------|--------------|--------------------------------------|--|-----|--------|------------------------|
| 13. | R1_S2 | Vishay-Dale  | CRCW04022K49FKED<br>Series= CRCW..e3 | Res= 2.49 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | 0402 3 mm <sup>2</sup> |
| 14. | R1_S3 | Vishay-Dale  | CRCW0402750RFKED<br>Series= CRCW..e3 | Res= 750.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | 0402 3 mm <sup>2</sup> |
| 15. | R1_S4 | Vishay-Dale  | CRCW0603158RFKEA<br>Series= CRCW..e3 | Res= 158.0 Ohm<br>Power= 100.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | 0603 5 mm <sup>2</sup> |
| 16. | R2_S2 | Vishay-Dale  | CRCW04023K83FKED<br>Series= CRCW..e3 | Res= 3.83 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | 0402 3 mm <sup>2</sup> |
| 17. | R2_S3 | Vishay-Dale  | CRCW04021K05FKED<br>Series= CRCW..e3 | Res= 1.05 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | 0402 3 mm <sup>2</sup> |
| 18. | R2_S4 | Vishay-Dale  | CRCW0402280RFKED<br>Series= CRCW..e3 | Res= 280.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | 0402 3 mm <sup>2</sup> |

## Design Inputs

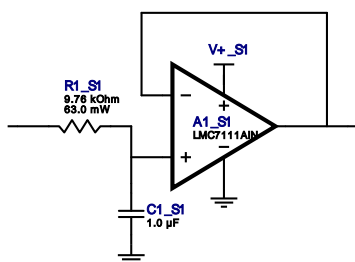
| #   | Name                | Value      | Description   |
|-----|---------------------|------------|---|
| 1.  | FilterType          | Lowpass    |   |
| 2.  | FilterResponse      | Chebyshev  |   |
| 3.  | FilterOrder         | 7.0        |   |
| 4.  | FilterTopology      | Sallen_Key |   |
| 5.  | NumberOfStages      | 4.0        |   |
| 6.  | PassbandFrequency   | 50.0       |   |
| 7.  | StopbandAttenuation | -60.0      |   |
| 8.  | StopbandFrequency   | 100.0      |   |
| 9.  | Gain                | 1.0        |   |
| 10. | SingleSupply        | 3.3        | 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 $\mu$  | Seed Capacitance to start design of filter          |

## Design Assistance

1. **LMC7111AIN** Product Folder : <http://www.ti.com//product/LMC7111> : contains the data sheet and other resources.

## Filter Stage :1

|                  |           |
|------------------|-----------|
| Cutoff Frequency | 16.216 Hz |
| Min GBW Req'd    | 810.8 Hz  |
| Stage Gain       | 1.0 V/V   |
| Stage Q          | 500.0 m   |
| Stage Topology   | Real_Pole |

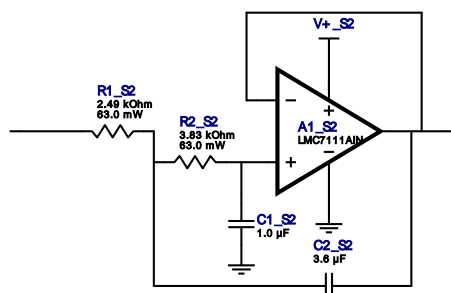


## Electrical BOM

| #  | Name  | Manufacturer      | Part Number                          | Properties   | Qty | Price  | Footprint                |
|----|-------|-------------------|--------------------------------------|--|-----|--------|--------------------------|
| 1. | A1_S1 | Texas Instruments | LMC7111AIN                           | GbwTyp= 50.0 mMHz<br>VccMin= 2.7 V<br>VccMax= 11.0 V | 1   | \$0.55 | DIP 0 mm <sup>2</sup>    |
| 2. | C1_S1 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 1.0 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %        | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 3. | R1_S1 | Vishay-Dale       | CRCW04029K76FKED<br>Series= CRCW..e3 | Res= 9.76 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | 0402 3 mm <sup>2</sup>   |

## Filter Stage :2

Cutoff Frequency 27.085 Hz  
 Min GBW Req'd 2.511 kHz  
 Stage Gain 1.0 V/V  
 Stage Q 927.0 m  
 Stage Topology Sallen\_Key

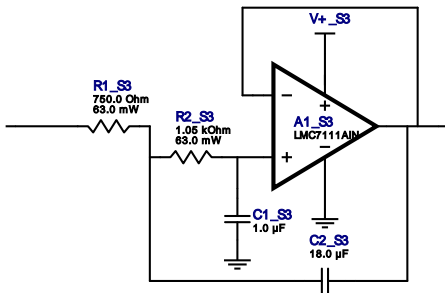


### Electrical BOM

| #  | Name  | Manufacturer      | Part Number                          | Properties   | Qty | Price  | Footprint                |
|----|-------|-------------------|--------------------------------------|--|-----|--------|--------------------------|
| 1. | A1_S2 | Texas Instruments | LMC7111AIN                           | GbwTyp= 50.0 mMHz<br>VccMin= 2.7 V<br>VccMax= 11.0 V | 1   | \$0.55 | DIP 0 mm <sup>2</sup>    |
| 2. | C1_S2 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 1.0 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %        | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 3. | C2_S2 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 3.6 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %        | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 4. | R1_S2 | Vishay-Dale       | CRCW04022K49FKED<br>Series= CRCW..e3 | Res= 2.49 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | 0402 3 mm <sup>2</sup>   |
| 5. | R2_S2 | Vishay-Dale       | CRCW04023K83FKED<br>Series= CRCW..e3 | Res= 3.83 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | 0402 3 mm <sup>2</sup>   |

## Filter Stage :3

Cutoff Frequency 42.321 Hz  
 Min GBW Req'd 8.858 kHz  
 Stage Gain 1.0 V/V  
 Stage Q 2.093  
 Stage Topology Sallen\_Key

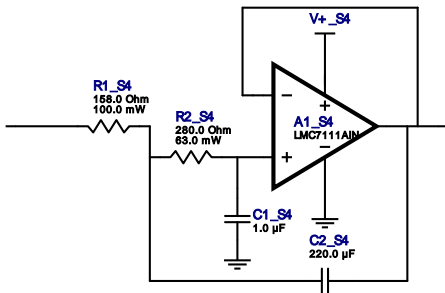


### Electrical BOM

| #  | Name  | Manufacturer      | Part Number                          | Properties   | Qty | Price  | Footprint                |
|----|-------|-------------------|--------------------------------------|--|-----|--------|--------------------------|
| 1. | A1_S3 | Texas Instruments | LMC7111AIN                           | GbwTyp= 50.0 mMHz<br>VccMin= 2.7 V<br>VccMax= 11.0 V | 1   | \$0.55 | DIP 0 mm <sup>2</sup>    |
| 2. | C1_S3 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 1.0 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %        | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 3. | C2_S3 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 18.0 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %       | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 4. | R1_S3 | Vishay-Dale       | CRCW0402750RFKED<br>Series= CRCW..e3 | Res= 750.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | 0402 3 mm <sup>2</sup>   |
| 5. | R2_S3 | Vishay-Dale       | CRCW04021K05FKED<br>Series= CRCW..e3 | Res= 1.05 kOhm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | 0402 3 mm <sup>2</sup>   |

## Filter Stage :4

|                  |            |
|------------------|------------|
| Cutoff Frequency | 51.373 Hz  |
| Min GBW Req'd    | 36.572 kHz |
| Stage Gain       | 1.0 V/V    |
| Stage Q          | 7.119      |
| Stage Topology   | Sallen_Key |



### Electrical BOM

| #  | Name  | Manufacturer      | Part Number                          | Properties   | Qty | Price  | Footprint                |
|----|-------|-------------------|--------------------------------------|--|-----|--------|--------------------------|
| 1. | A1_S4 | Texas Instruments | LMC7111AIN                           | GbwTyp= 50.0 mMHz<br>VccMin= 2.7 V<br>VccMax= 11.0 V | 1   | \$0.55 | DIP 0 mm <sup>2</sup>    |
| 2. | C1_S4 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 1.0 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %        | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 3. | C2_S4 | CUSTOM            | CUSTOM<br>Series= ?                  | Cap= 220.0 uF<br>VDC= 0.0 V<br>Tolerance= 0.0 %      | 1   | NA     | CUSTOM 0 mm <sup>2</sup> |
| 4. | R1_S4 | Vishay-Dale       | CRCW0603158RFKEA<br>Series= CRCW..e3 | Res= 158.0 Ohm<br>Power= 100.0 mW<br>Tolerance= 1.0% | 1   | \$0.01 | 0603 5 mm <sup>2</sup>   |
| 5. | R2_S4 | Vishay-Dale       | CRCW0402280RFKED<br>Series= CRCW..e3 | Res= 280.0 Ohm<br>Power= 63.0 mW<br>Tolerance= 1.0%  | 1   | \$0.01 | 0402 3 mm <sup>2</sup>   |

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