



AS3320 - Voltage controlled filter (VCF)

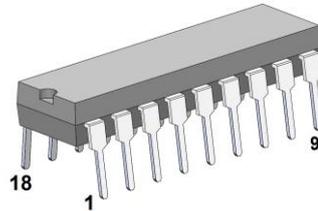
FEATURES

- voltage controllable frequency - 12 octave range
- voltage controllable resonance - from zero to oscillation
- accurate exponential frequency scale
- accurate linear resonance scale
- low control voltage feedthrough -45dB typical
- filter configurable into LPF, HPF, all pass, etc.
- low noise: -86dB typical
- low distortion in passband - 0.1% typical
- low warm up drift
- configurable into low distortion voltage controlled sine wave oscillator
- bandwidth till 800kHz

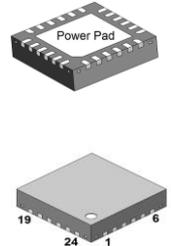
APPLICATIONS

for electronic music

AS3320
PDIP-18 (300 mil)



AS3320F
QFN-24 4x4mm 0,5mm



General Description

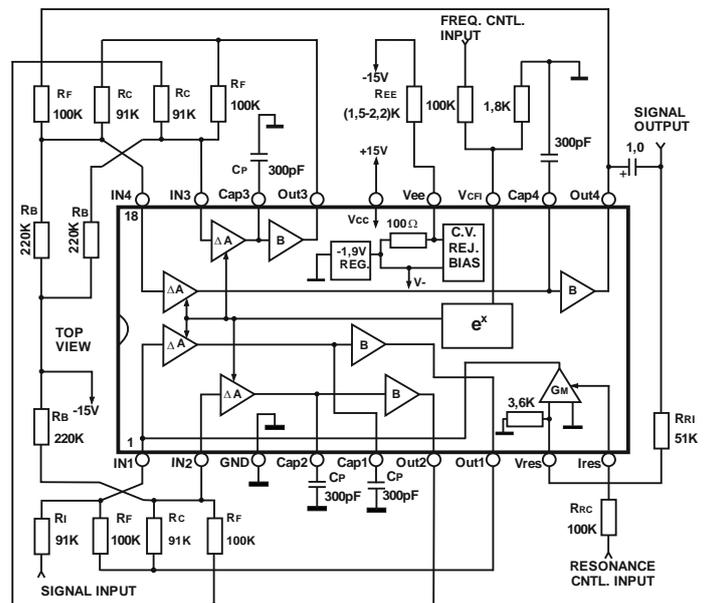
The AS3320 is a high performance voltage controlled four-pole filter with on-chip voltage controllable resonance IC. The four independent sections may be interconnected to provide a wide variety of filter responses, such as low pass, high pass, band pass and all pass. A single input exponentially controls the frequency over greater than a ten octave range with little control voltage feedthrough. Another input controls the resonance in a modified linear manner from zero to low distortion oscillation. For those demanding applications, provision has been made to allow trimming for improved control voltage rejection. Each filter section features a variable gain cell which is fully temperature compensated, exhibits a better signal-to-noise ratio and generates its low distortion predominantly in the second harmonic. The device includes a minus two volt regulator to ensure low power dissipation and consequent low warm-up drift.

Power pad in QFN package highly improves thermal stability of parameters of AS3320F.

Pin Information

| PDIP-18 Pin No | QFN-24L Pin No | Pin Name | Description |
|-------------------|-------------------|-------------|---------------------------------|
| 1 | 4 | IN1 | Input Stage 1 |
| 2 | 5 | IN2 | Input Stage 2 |
| 3 | 7 | GND | Ground |
| 4 | 8 | Cap2 | Capacitor Stage 2 |
| 5 | 9 | Cap1 | Capacitor Stage 1 |
| 6 | 11 | Out2 | Output Stage 2 |
| 7 | 12 | Out1 | Output Stage 1 |
| 8 | 14 | Vres | Resonance Input |
| 9 | 15 | Ires | Resonance Control Input |
| 10 | 16 | Out4 | Output Stage 4 |
| 11 | 17 | Cap4 | Capacitor Stage 4 |
| 12 | 19 | VCFI | Voltage Control Frequency Input |
| 13 | 20 | Vee | Negative power |
| 14 | 22 | Vcc | Positive power |
| 15 | 23 | Out3 | Output Stage 3 |
| 16 | 24 | Cap3 | Capacitor Stage 3 |
| 17 | 2 | IN3 | Input Stage 3 |
| 18 | 3 | IN4 | Input Stage 4 |
| - | Power pad | Power pad | Don't connect |

Circuit Block and Connection Diagram (PDIP-18)



Absolute Maximum Ratings

| | |
|--|-----------------|
| Voltage between Vcc and Vee pins | +22V, -0,5V |
| Voltage between Vcc and GND pins | +18V, -0,5V |
| Voltage between Vee and GND pins | -4V, -0,5V |
| Voltage between Cell Input and GND pins | +0,5V, -6V |
| Voltage between Frequency Control and GND pins | ±6V |
| Voltage between Resonance Control and GND pins | +2V, -18V |
| Current through any pin | ±40mA |
| Storage Temperature Range | - 55°C to 150°C |
| Operating Temperature Range | - 25°C to 75°C |



Electrical Characteristics *

$V_{CC}=+15V$ $R_F = 100K$ $T_A= 25^{\circ}C$

| Parameter | Min. | Typ. | Max. | Units |
|---|----------|----------|-----------|------------|
| Gain of Variable Gain Cell at $V_{CFI}=0$ | 0.7 | 1 | 1,3 | |
| Input Bias Current of Frequency Control Input | 0.2 | 1 | 1.5 | μA |
| Input Impedance of Resonance Signal Input | 2.7 | 3.6 | 4.5 | K Ω |
| Output Swing At Clipping | 10 | 12 | 14 | V.P.P. |
| Output voltage DC ¹ | 5 | 6.5 | 9 | V |
| Buffer Input Bias Current | ± 10 | ± 30 | ± 100 | nA |
| Buffer Output Impedance ² | 25 | 50 | 100 | Ω |
| Voltage at the negative supply pin ³ | -2.4 | -2.7 | -2.9 | V |
| Positive Supply Current, I_{CC} | 3.8 | 5 | 6.5 | mA |
| Negative Supply Current, I_{EE} ³ | 8 | 8.4 | 8.8 | mA |

Typical Electrical Characteristics

| Parameter | Min. | Typ. | Max. | Units |
|--|--------|----------|------|------------|
| Pole Frequency Control Range ⁴ | 3500:1 | 10,000:1 | - | |
| Sensitivity of Pole Frequency Control Scale, Midrange | 57.5 | 60 | 62.5 | mV/decade |
| Tempco of Pole Frequency Control Scale | 3000 | 3300 | 3600 | ppm |
| Exponential Error of Pole Frequency Control Scale ⁵ | - | 4 | 12 | % |
| Max Gain of Variable Gain Cell | 2.4 | 3 | 3.6 | |
| Tempco of Variable Gain Cell ⁶ | - | 500 | 1500 | ppm |
| Output Impedance of Gain Cell ⁶ | 0.5 | 1 | 2 | M Ω |
| Pole Frequency Control Feedthrough | - | 60 | 200 | mV |
| Pole Frequency Warm-up Drift | - | 0.5 | 1.5 | % |
| Gm of Resonance Control Element at $I_{CR}=100\mu A$ | 0.8 | 1 | 1.2 | mmhos |
| Amount of Resonance Obtainable Before Oscillation | 20 | 30 | - | dB |
| Resonance Control Feedthrough ⁷ | - | 0.2 | 1,5 | V |
| Output Noise re Max Output ⁸ | -76 | -86 | - | dB |
| Rejection in Bandreject | 73 | 83 | - | dB |
| Distortion in Passband ^{9,11} | - | 0.1 | 0.3 | % |
| Distortion in Bandreject ^{10,11} | - | 0.3 | 1 | % |
| Distortion of Sine Wave Oscillation ¹² | - | 0.5 | 1.5 | % |
| Internal Reference Current, I_{REF} | 45 | 63 | 85 | μA |
| Buffer Slew Rate | 1.5 | 3 | - | V/ μS |
| Buffer Sink Capability | 0.4 | 0.5 | 0.63 | mA |
| Positive Supply Range, V_{CC} | +9 | - | +18 | V |
| Negative Supply Range, V_{EE} ³ | -4 | - | -18 | V |

***) Specifications subject to change without notice.**

Note 1: $V_{IN} = 0$, $R_C = 91K\Omega$, $R_F = 100K\Omega$

Note 2: $V_{CFI} = 0$

Note 3: Current limiting resistor always required. $R_{EE} = (1.5 \div 2.2)K\Omega$

Note 4: $-20mV < V_{CFI} < +160mV$

Note 5: $-16mV < V_{CFI} < +176mV$. Most of this error occurs in upper two octaves.

Note 6: $V_{CFI} = 0$

Note 7: Untrimmed. $0 < I_{CR} < 100\mu A$

Note 8: Filter is connected as low pass and set for 20 KHz cut-off frequency.

Note 9: Output signal is 3dB below clipping point.

Note 10: Output signal is 3dB below passband level, which is 3dB below clipping point. In general, this is worst case condition.

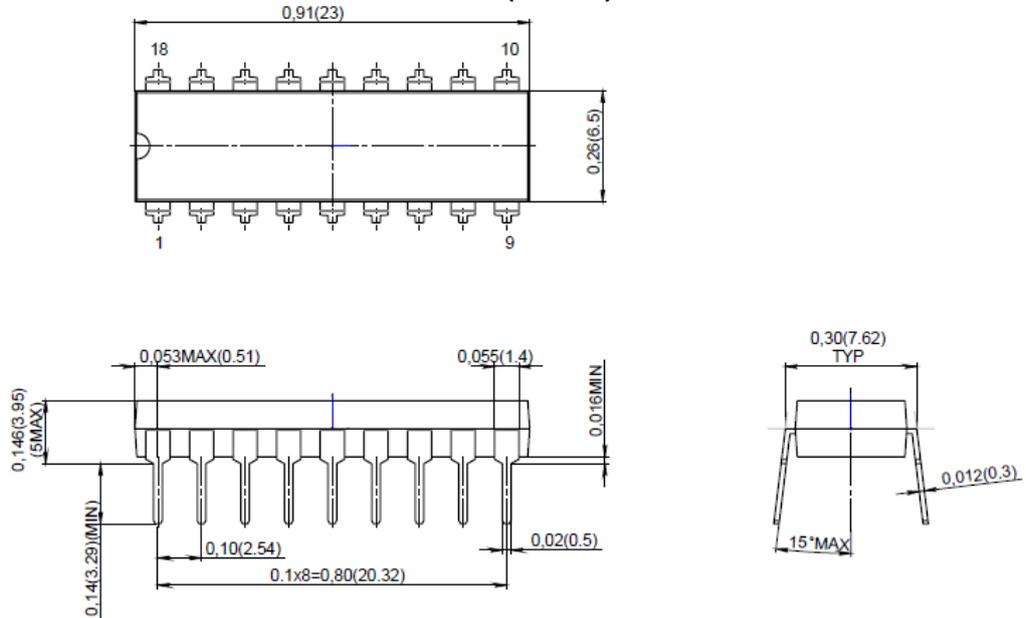
Note 11: Distortion is predominantly second harmonic.

Note 12: Sinewave is not clipped by first stage.

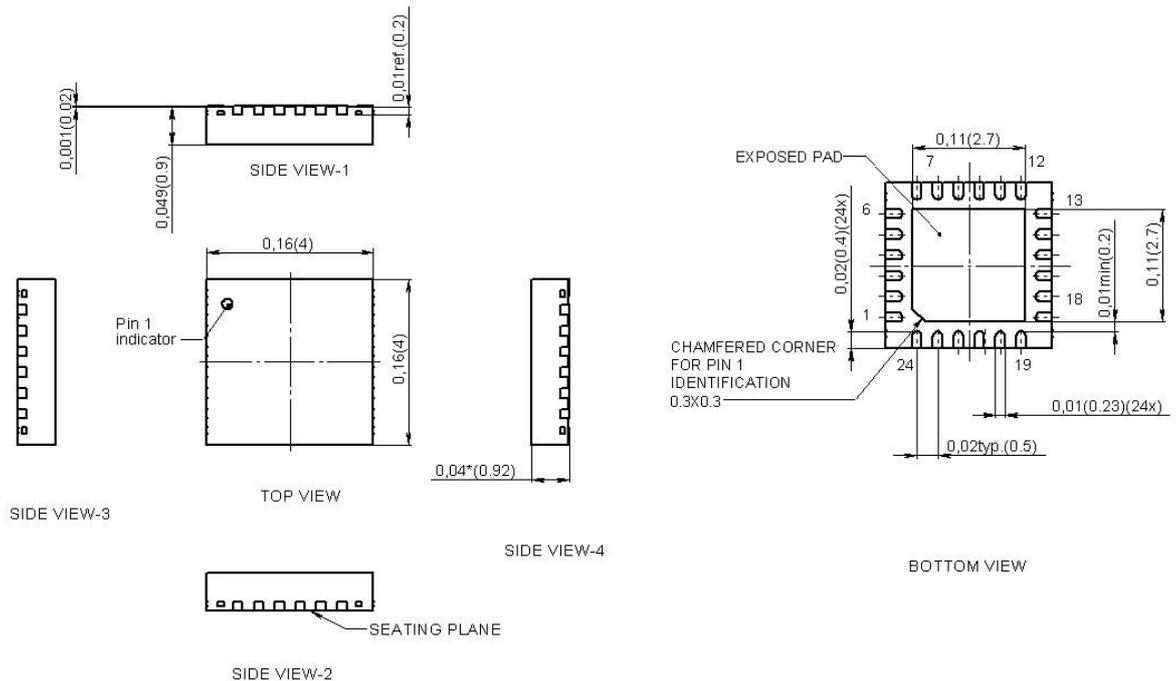
| Device type | Package |
|-------------|-------------------------|
| AS3320 | PDIP-18 (300 mil body) |
| AS3320F | QFN-24L (4x4 mm 0.5 mm) |

Package Information

PDIP-18 (300 mil)



QFN-24 4x4 mm 0.5 mm



Revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 05-Oct-2016 | 1 | Short version 1 |
| 09-Jan-2017 | 2 | QFN-24L – new package |
| 20-Mar-2017 | 3 | Drawing and typical electrical characteristics updated |
| 09-May-2017 | 4 | Block circuit and typical electrical characteristics updated |
| 29-May-2017 | 5 | Minor changes |
| 21-May-2018 | 6 | Minor changes |