ACO100 Audio Controlled Oscillator

- Direct audio to analog square/saw oscillator output
- 1V/octave pitch CV output (with calibrated post-amplifier)
- -2 to +2 octave modulation CV input
- 8-step minus fifth to plus fourth harmony modulation CV input
- Tiny 5mm x 5mm QFN32L footprint
- 20mA max current consumption from 4.5-5.5v supply ideal for battery-powered applications
- One-cycle latency
- 25Hz-6.4kHz frequency tracking range

Applications

- Audio-controlled modular and semi-modular synthesizers
- Pitch-to-CV converters
- Harmonizers
- Guitar and other instrument effects/stompboxes

Description

The ACO100 audio-controlled oscillator is an ultra-low latency, low-power frequency-tracking oscillator suitable for audio-controlled music synthesizer applications. It contains a level-crossing detector, ultrasonic analog oscillator and frequency tracking engine that forces the analog oscillator to run at 8192 times the frequency of the incoming audio signal detected by the level-crossing detector. This ultrasonic analog oscillator is then divided back down to audio range using programmable dividers that are controlled by the octave and harmony CV inputs.

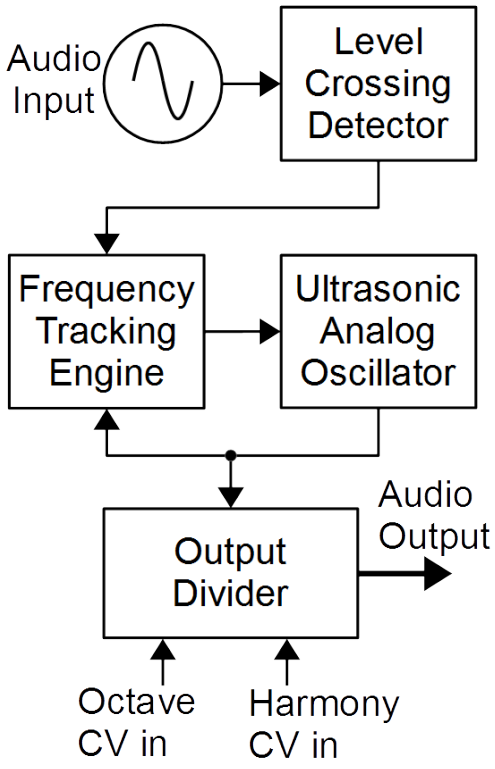
The ACO100 consumes only 20mA max from a 5V power supply, making it ideal for battery-powered applications. Together with other signal conditioning blocks such as an envelope detector, VCA, VCF, PWM, the ACO100 can provide a complete low-power audio-controlled synthesizer solution.

The ACO100 can be combined with a suitably-designed VCF controlled by the ACO100's own PITCH CV output to further improve the quality of the pitch tracking. This VCF conditions the input signal to yield a waveform closer to an ideal sine wave. This configuration is shown in the example schematic at the end of this datasheet.

Device Information

Part Number	Package	Body Size
ACO100	QFN32L	5mm x 5mm

Simplified Block Diagram



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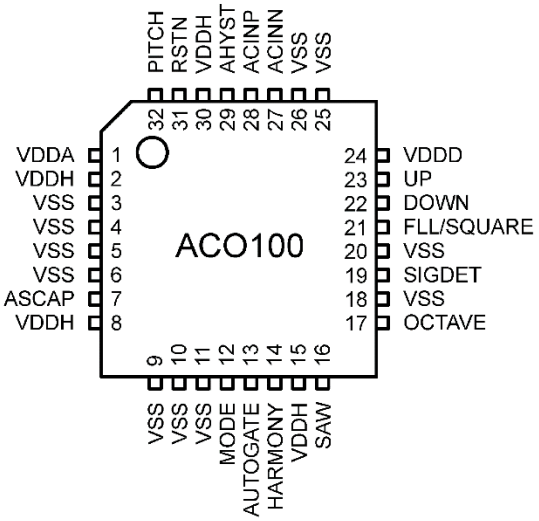
32-pin QFN pinout



ACO100 Pins

Pin	Name	Direction	Description
1	VDDA	Supply	3.3v analog supply, bypass with 1.0-2.2uF ceramic capacitor
2	VDDH	Supply	4.5-5.5v I/O supply
3	VSS	Supply	Ground
4	VSS	Supply	Ground
5	VSS	Supply	Ground
6	VSS	Supply	Ground
7	ASCAP	Input	Tuning input for DC offset of PITCH output, tunable from VSS to VDDH in 8 discrete steps
8	VDDH	Supply	4.5-5.5v I/O supply
9	VSS	Supply	Ground
10	VSS	Supply	Ground
11	VSS	Supply	Ground
12	MODE	Input	0-VDDH mode input: MODE = 0: Test mode only, oscillators off MODE = 1: Audio oscillators on
13	AUTOGATE	Input	0-VDDH enable auto-gating AUTOGATE = 0: autogate turned off AUTOGATE = 1: autogate turned on
14	HARMONY	Input	0v-VDDH/8: 2:3 or -7 semitones (-2 cents error) VDDH/8-2*VDDH/8: 16:21 or -5 semitones (+29 cents error) 2*VDDH/8-3*VDDH/8: 4:5 or -4 semitones (+14 cents error) 3*VDDH/8-4*VDDH/8: 32:35 or -2 semitones (+45 cents error) 4*VDDH/8-5*VDDH/8: 1:1 or perfect unison 5*VDDH/8-6*VDDH/8: Rising: 8:7 or +2 semitones (+31 cents error) Falling: 16:15 or +1 semitone (+12 cents error) 6*VDDH/8-7*VDDH/8: 32:25 or +4 semitones (+27 cents error) 7*VDDH/8-VDDH: 4:3 or +5 semitones (-2 cents error)

Pin	Name	Direction	Description
15	VDDH	Supply	4.5-5.5v I/O supply
16	SAW	Output	0-VDDA Sawtooth wave output
17	OCTAVE	Input	0-VDDH/8: Shift ACO pitch by -2 octaves VDDH/8-3*VDDH/8: Shift ACO pitch by -1 octave 3*VDDH/8-5*VDDH/8: ACO pitch octave unchanged 5*VDDH/8-7*VDDH/8: Shift ACO pitch by +1 octave 7*VDDH/8-VDDH: Shift ACO pitch by +2 octaves
18	VSS	Supply	Ground
19	SIGDET	Output	Outputs VDDH when input signal is detected
20	VSS	Supply	Ground
21	FLL/ SQUARE	Output	In synchronous sample clock mode (MODE = 0) ACO output divided down by the appropriate power of two to give a sample frequency roughly between 100kHz and 200kHz In analog synth mode (MODE = 1), outputs 0-VDDA square wave
22	DOWN	Output	In synchronous sample clock mode (MODE = 0), single pulse over one cycle of FLL output when the sample frequency drops by 2x In analog synth mode (MODE = 1), quiet
23	UP	Output	In synchronous sample clock mode (MODE = 0), single pulse over one cycle of FLL output when the sample frequency increases by 2x In analog synth mode (MODE = 1), quiet
24	VDDD	Supply	3.3v digital supply, bypass with 1.0-2.2uF ceramic capacitor and connect to VDDA on the PCB
25	VSS	Supply	Ground
26	VSS	Supply	Ground
27	ACINN	Input	Negative polarity audio input
28	ACINP	Input	Positive polarity audio input
29	AHYST	Input	8-level hysteresis control for fundamental frequency detection circuit. Connect to VDDH for best results.
30	VDDH	Supply	4.5-5.5v I/O supply
31	RSTN	Input	0-VDDH Asynchronous active low reset
32	PITCH	Output	Pitch CV out at approximately 0.42v/oct

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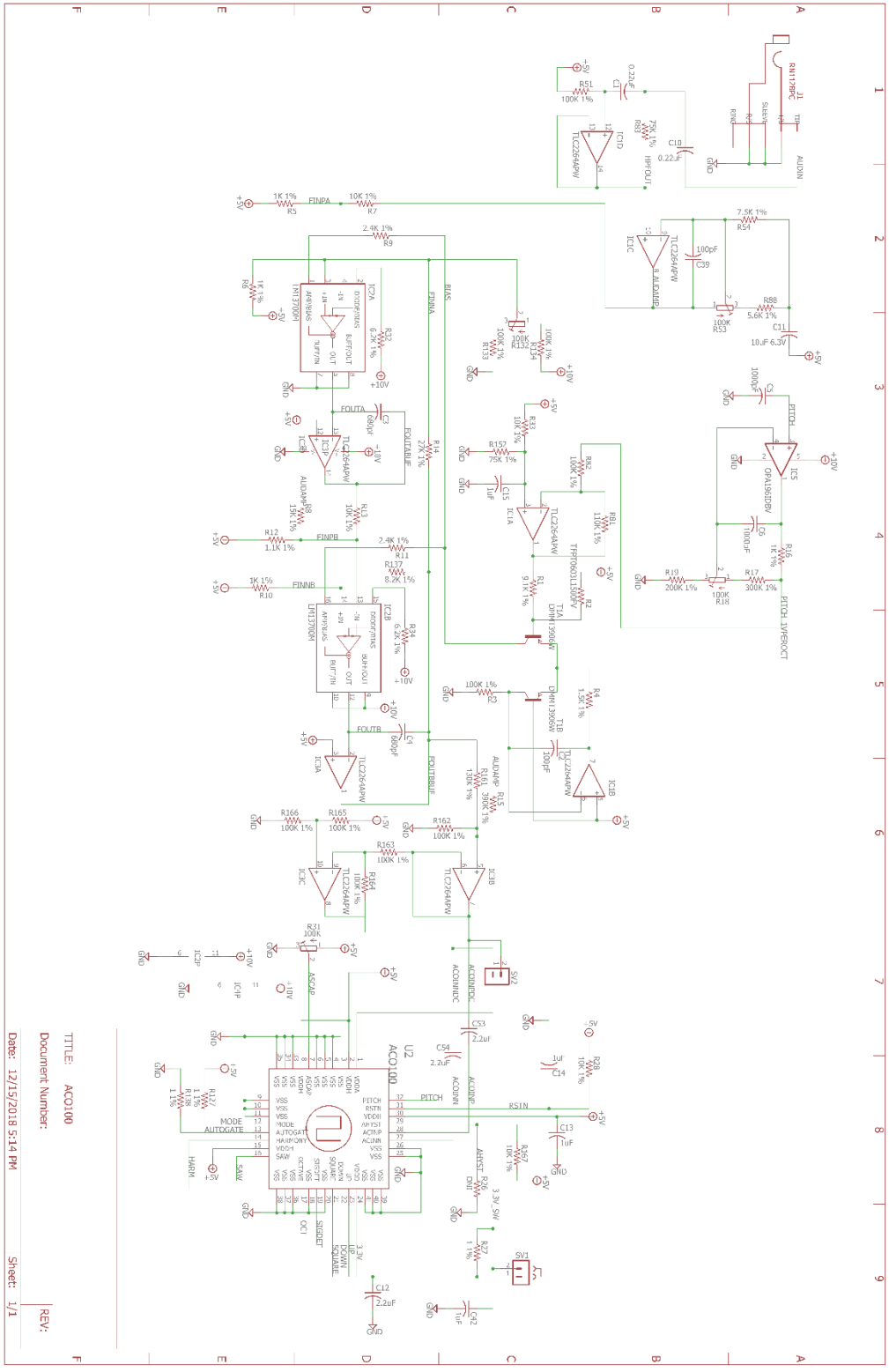

Example Schematic Using ACO100

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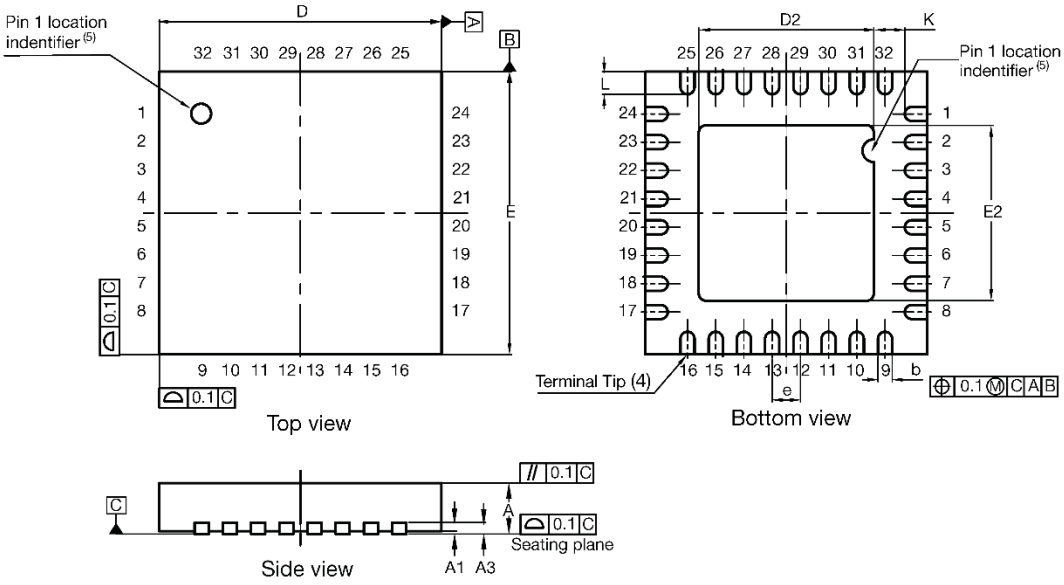
Package Information for 32-pin QFN

QFN32 5 x 5 Case Outline



DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.75	0.85	0.95	0.029	0.033	0.037
A1	0.00	-	0.05	0.000	-	0.002
A3	0.20 ref.			0.008 ref.		
b	0.18	0.25	0.30	0.007	0.010	0.012
D	5.00 BSC			0.197 BSC		
D2	3.00	3.10	3.20	0.118	0.122	0.126
e	0.50 BSC			0.020 BSC		
E	5.00 BSC			0.197 BSC		
E2	3.00	3.10	3.20	0.118	0.122	0.126
K	0.20	-	-	0.008	-	-
L	0.30	0.40	0.50	0.012	0.016	0.020
N (3)	32			32		
Nd (3)	8			8		
Ne (3)	8			8		

Notes

(1) Use millimeters as the primary measurement
(2) Dimensioning and tolerances conform to ASME Y14.5M. - 1994
(3) N is the number of terminals,
Nd is the number of terminals in X-direction and
Ne is the number of terminals in Y-direction.
(4) Dimension b applies to plated terminal and is measured between 0.15 mm and 0.30 mm from terminal tip
(5) The pin #1 identifier must be existed on the top surface of the package by using indentation mark or other feature of package body
(6) Package warpage max. 0.05 mm

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