ACO160EVK Audio-to-Synth System

- Direct audio to analog square/sawtooth/sine oscillator output
- 1V/octave pitch CV output
- Rail-to-rail output zero-ripple envelope follower
- Modulation CV input with +/-2 octave range and semitone resolution
- Gate output with user-configurable threshold
- 25Hz-5.2kHz frequency tracking range
- Low-latency MIDI out with included STM32F100C4 uC
- Hard sync oscillator controlled from uC

Applications

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

Description

The ACO160EVK Audio-to-Synth system is an evaluation system for the ACO160 audio-controlled oscillator, a ultra-low latency, low-power frequency-tracking oscillator suitable for audio-controlled music synthesizer applications. The ACO160 contains a fundamental frequency detector based on dual switched-capacitor peak detectors with frequency-dependent decay time for ultra-wide detection range, 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 at the input. This ultrasonic analog oscillator is then divided back down to audio range using programmable dividers that are controlled by the harmony CV input and which cover a +/-2 octave range with semitone precision over the entire range.

Additionally, the ACO160 features an integrated switched-capacitor envelope follower which exhibits zero ripple, even for the lowest frequency signals the chip can detect (down to 25Hz). An integrated gate generation comparator has the envelope signal wired to its positive input and allows the user to set the voltage on the negative input. This voltage functions as the gate threshold and generates a rail-to-rail gate CV output.

The ACO160EVK additionally includes a balanced preamp with combo XLR + ¼" jack input with 0-50dB gain, adjustable high-pass and low-pass filters for improved frequency detection (if needed) in front of the ACO160 chip, a VCA controlled either by the built-in envelope follower or by an external source, an auxiliary mixer to mix another synth voice after the VCA, and a STM32F100C4 micro-controller to convert the frequency, envelope and gate information provided by the ACO160 chip into MIDI commands to control digital synthesizers.

The ACO160EVK is meant to assist analog or digital synth manufacturers with designing an audio-controlled synth and is not intended to serve as a finished consumer product.

Ordering Information

Part Number	Package	Size
ACO160EVK	PCB	140mm x 120mm

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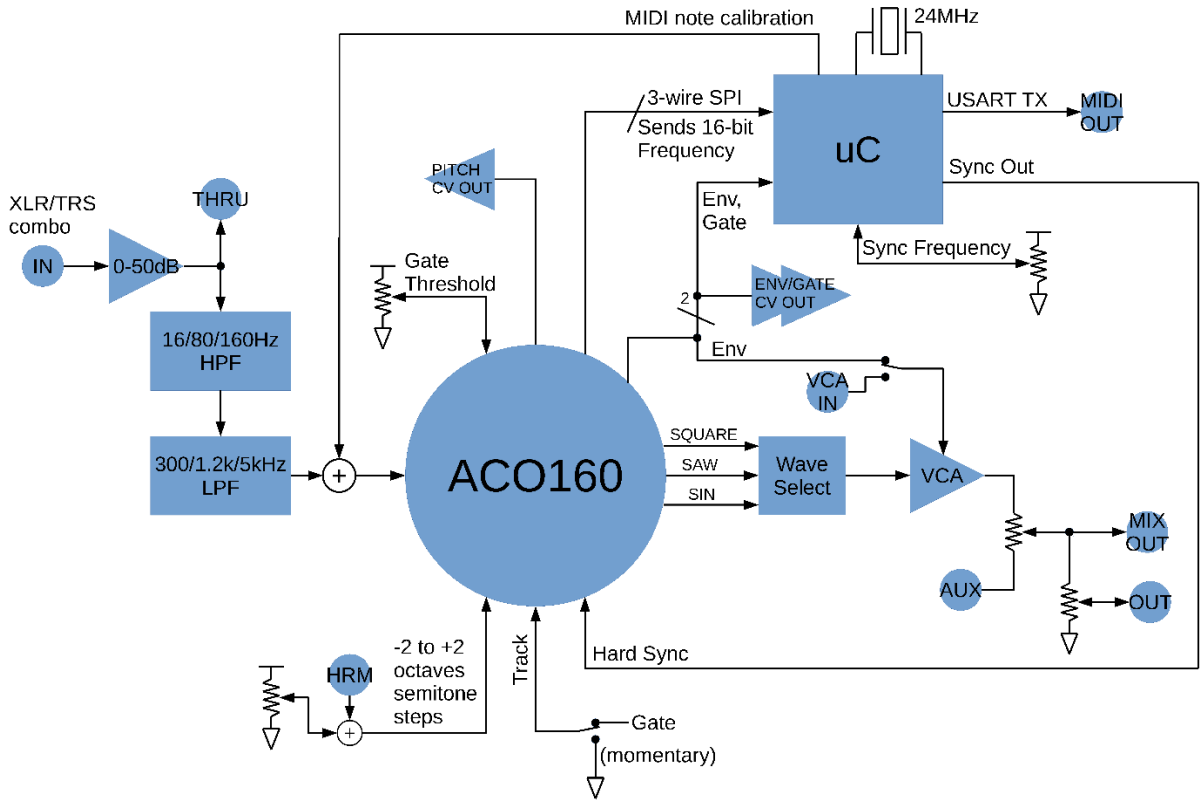
Block Diagram of ACO160EVK Audio-to-Synth Evaluation System



ACO160EVK Inputs and Outputs

Name	Direction	Description
Audio In	Input	Audio input from Neutrik XLR-¼" combo jack
Audio Thru	Input/Output	Unbalanced minijack audio input (LINE IN) and output (LINE OUT) after 0-50dB gain preamp
Harmony	Input	1v/oct minijack harmony input modulates square/saw/sine frequencies over +/-2 octave range on 12-note equal-tempered scale
VCA In	Input	External minijack VCA input, if unpatched VCA is controlled by the envelope follower from the ACO160 chip
Aux In	Input	Minijack auxiliary audio input can be mixed in after the VCA
Mix Out	Output	Minijack output of the auxiliary audio mixer
Main Out	Output	¼" mono main output (equivalent to the aux mixer out followed by master volume control
Pitch CV	Output	1v/oct pitch CV out (minijack)
Env CV	Output	0-4.5v output of zero-ripple envelope follower (minijack)
Gate CV	Output	0-4.5v gate CV out (minijack)
MIDI out	Output	Standard MIDI DIN output

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ACO160EVK Controls

Name	Type	Description
Preamp Gain	Knob	Adjusts preamp gain from 0-50dB.
HPF	Switch	High-pass filter corner frequency set to 16/80/160Hz.
LPF	Switch	Low-pass filter corner frequency set to 300/1.2k/5kHz.
Gate Threshold	Knob	Tunes gate threshold from 0v to 3.3v.
Env Rate Select	8-Pos Rotary Switch	Adjusts the envelope decay rate to accommodate various instruments. Use fast rate (CCW) with fast-decaying sources like bass guitar and slower rate (CW) for sources with complex harmonic profile like violin.
Wave	Switch	Selects square/saw/sine wave for processing by VCA.
Pitch Freeze	Switch	By default, connects gate out to FTRACK input to enable frequency tracking. Can be momentarily held in opposing position to disable frequency tracking and freeze the current pitch.
Harmony	Knob	Offsets harmony shift to accommodate various CV ranges.
Aux Mix	Knob	Mixes VCA output with auxiliary audio input from Aux In
Output Level	Knob	Output master volume
Sync Freq	Knob	Adjusts hard sync oscillator generated by uC over 10-10kHz range. Setting knob fully CCW turns off the sync oscillator.
Bend/Cal Mode	Switch	Sets MIDI pitch bend mode: Left = Quantize MIDI notes to 12-note equal-tempered scale; Middle = Pitch bend over +/-1 quartertone only; Right = Pitch bend over full +/-2 semitones. If CAL button is held down, generate calibration tones as follows: Left = 100Hz; Middle = alternating 100/800Hz; Right = 800Hz
Cal	Button	Hold button down to generate calibration tones as described above in description of Bend/Cal Mode switch. When button is released frequency-to-MIDI non-linearity correction calibration is performed.
Reset	Button	Global reset for micro-controller and ACO160 chip

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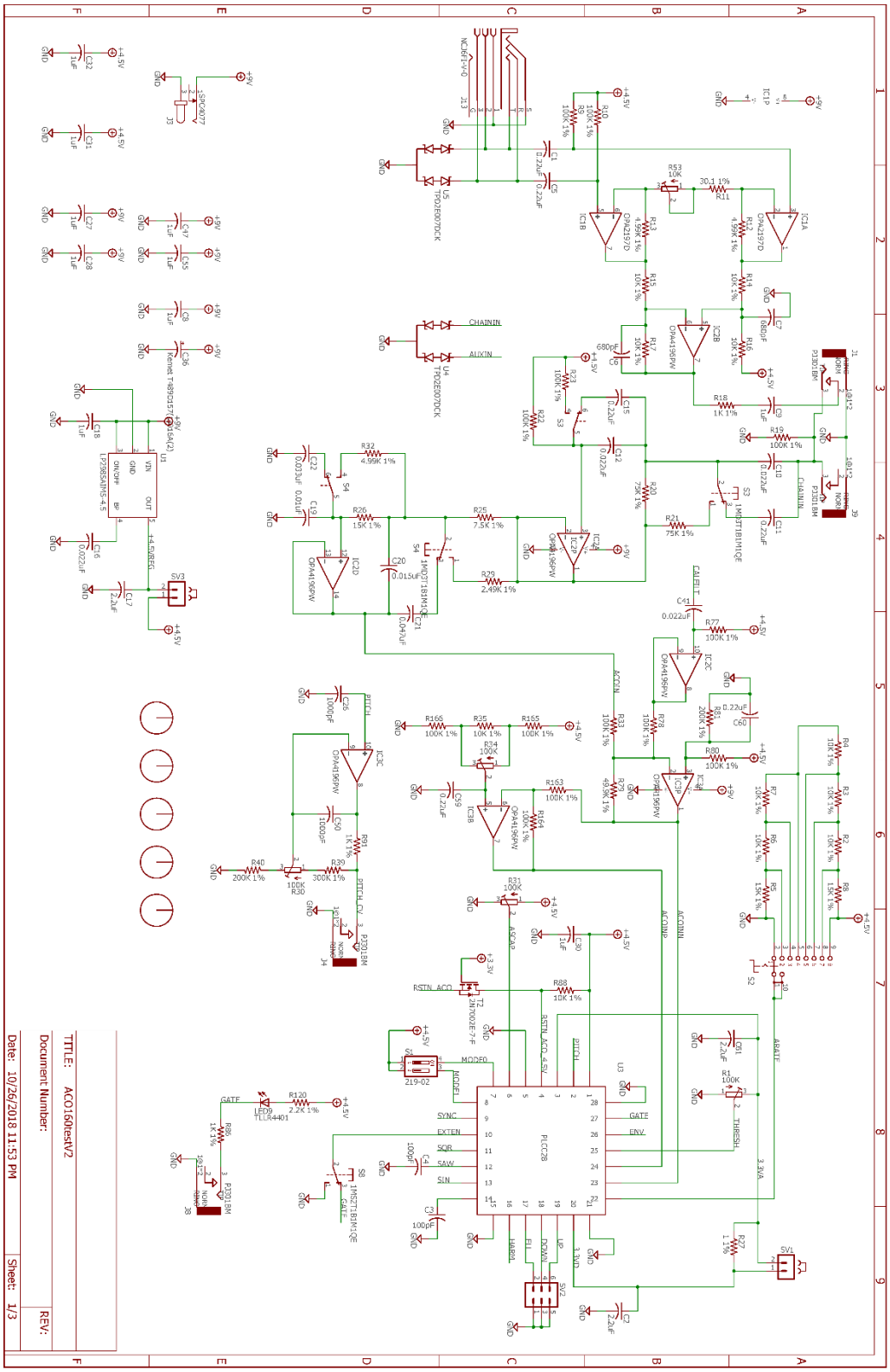

ACO160EVK Schematic – Page 1

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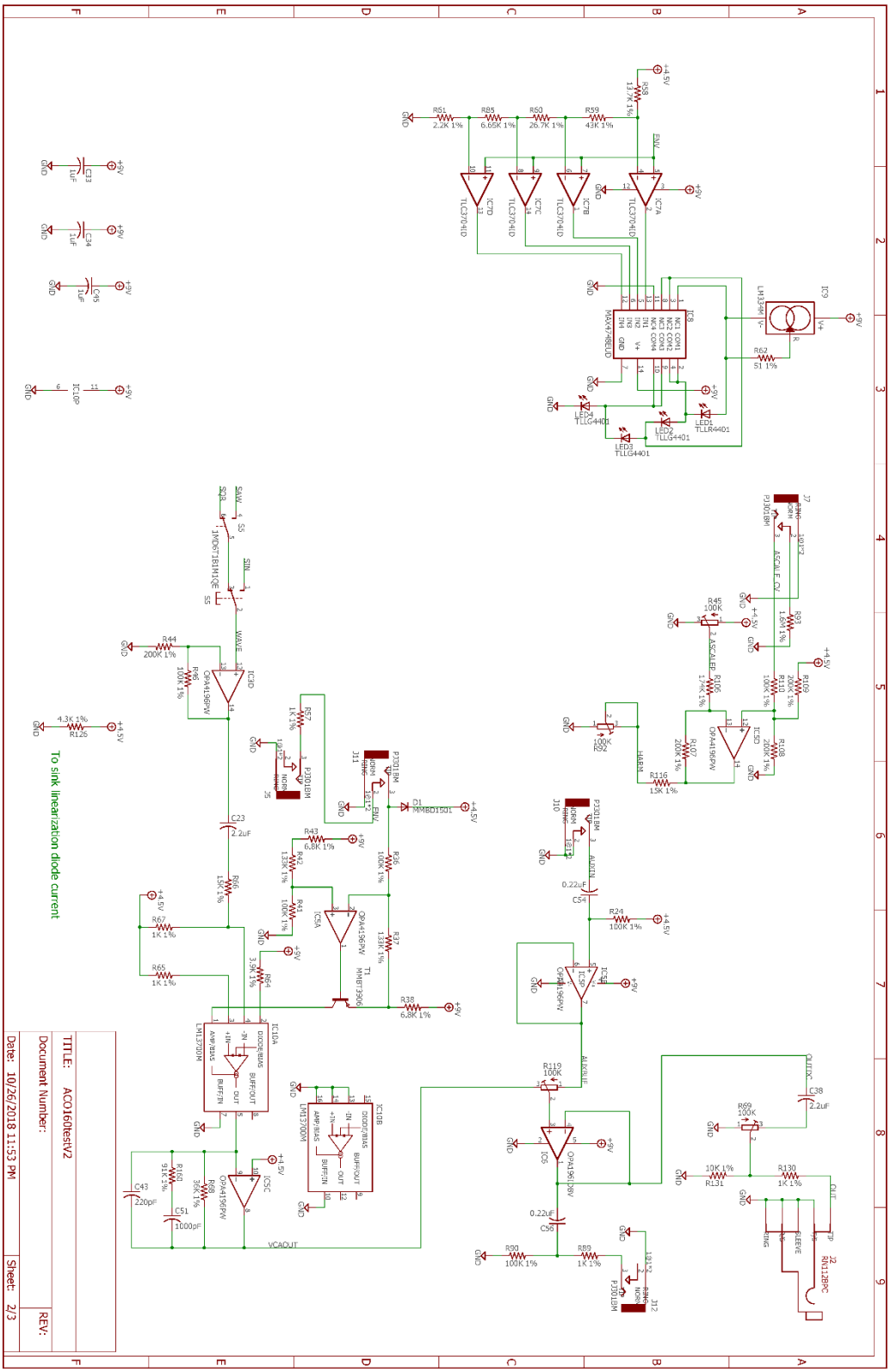

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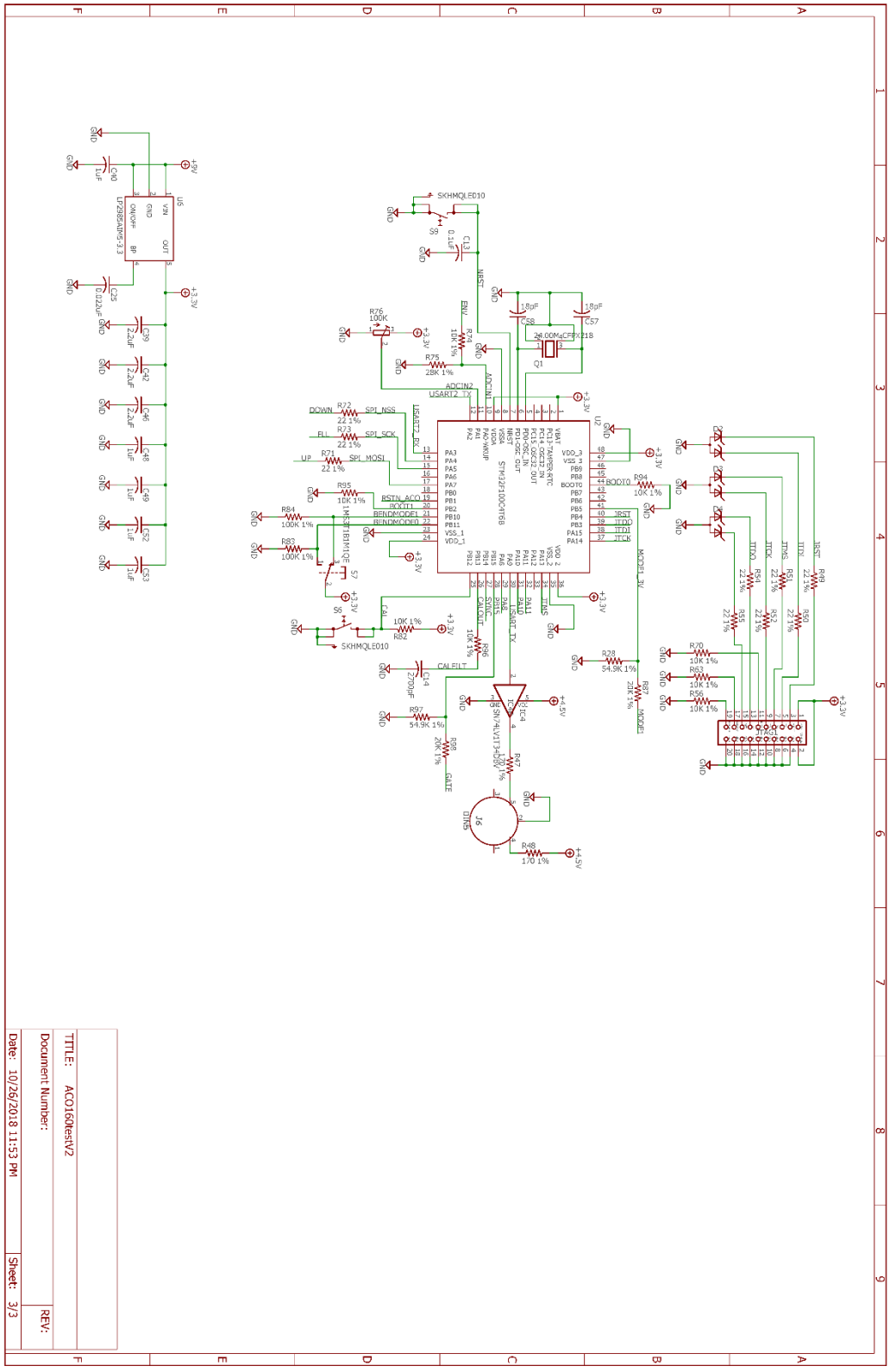

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