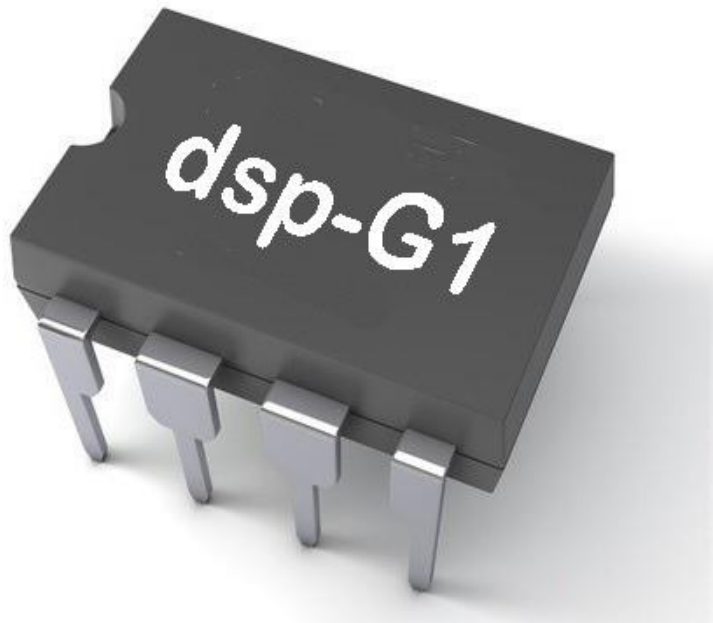


dsp-G1 MIDI-Synthesizer Chip

World's smallest
Analog Modeling Synthesizer



Application Manual v1.0

The dsp-G1 MIDI-Synthesizer Chip

The **dsp-G1** synthesizer is a chip that contains a full analog modelling MIDI synthesizer in an 8-pin DIP package.

The chip can be used as a voice chip for an analog synthesizer, either as standalone receiving MIDI from a keyboard or other MIDI source, or connected to another MCU used for programming and patch storage.

The synth is five-voice paraphonic with three DCO's per voice for a total of 15 oscillators, a +24dB resonant lowpass filter, two ADSR envelope generators and a LFO with sine and sample & hold waveform.

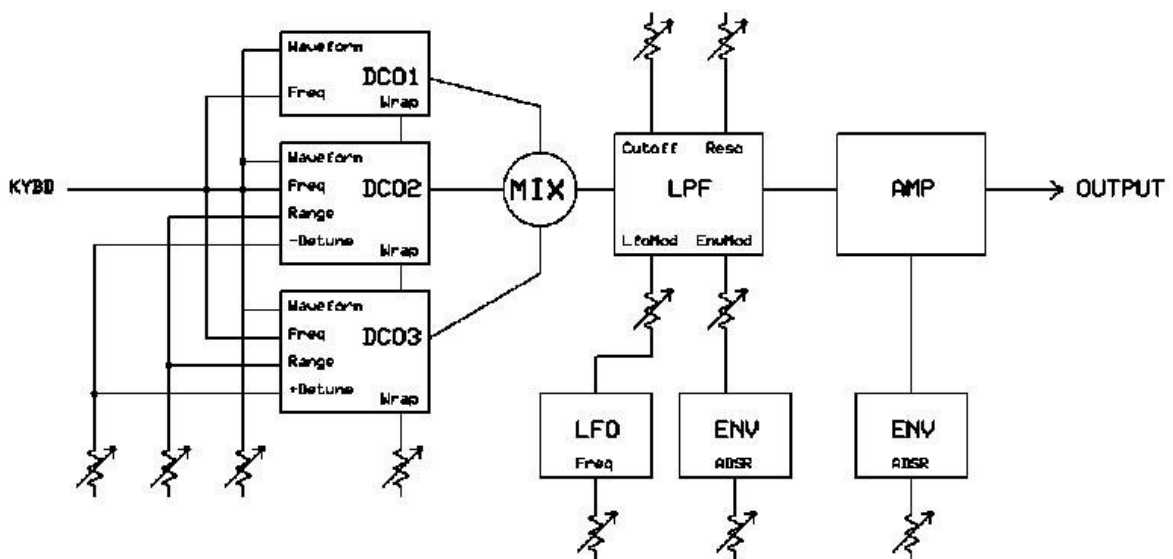
The DCO's are TRI / PULSE / SAW morphing oscillators with range, detune and wrap parameters. The wrapping is a form of pulse width adjustment that works on any waveform.

The digitally controlled filter (DCF) is a digital model of a +24dB 4-pole filter and has a resonance setting that can be driven to near self oscillation. It has routing for ENV and LFO modulation.

Two ENV's are standard ADSR type and modulate the DCF and the DCA.

One LFO is provided for DCF modulation and has TRI or S/H waveforms.

The output is 44.1KHz Sigma-Delta DAC and the synth parameters are controlled through 19 MIDI-CC parameters.



The structure for the dsp-G1 Analog Modeling Synth

MIDI implementation

Note On	
0x90, 0xNN, 0xVV	Note On, velocity not implemented

Note Off	
0x80, 0xNN, 0xVV	Note Off, velocity not implemented

CC-07 Master Volume	
0xB0, 0x07, 0xCC	Master Volume 0-127

CC-01 LFO Filter Modulation	
0xB0, 0x01, 0xCC	Modulation Level 0-127

CC-16 LFO Rate	
0xB0, 0x10, 0xCC	LFO Rate 0-127

CC-20 LFO Waveform	
0xB0, 0x14, 0xCC	LFO Waveform 0-63 TRI, 64-127 S/H

CC-74 DCF Cutoff	
0xB0, 0x4A, 0xCC	Filter Cutoff 0-127

CC-71 DCF Resonance	
0xB0, 0x47, 0xCC	Filter Resonance 0-127

CC-82 DCF Env Attack	
0xB0, 0x52, 0xCC	Filter Env Attack Rate 0-127

CC-83 DCF Env Decay	
0xB0, 0x53, 0xCC	Filter Env Decay Rate 0-127

CC-28 DCF Env Sustain

0xB0, 0x1C, 0xCC

Filter Env Sustain Level 0-127

CC-29 DCF Env Release

0xB0, 0x1D, 0xCC

Filter Env Release Rate 0-127

CC-81 DCF Env Modulation

0xB0, 0x51, 0xCC

Filter Env Modulation Level 0-127

CC-76 DCO Waveform

0xB0, 0x4C, 0xCC

Osc Wave TRI/PULSE/SAW 0-127

CC-04 DCO Wrap

0xB0, 0x04, 0xCC

Waveform Wrap Modulation 0-127

CC-21 DCO Range

0xB0, 0x15, 0xCC

Oscillator 2/3 Range 0-127

CC-93 DCO Detune

0xB0, 0x5D, 0xCC

Oscillator 2/3 Range 0-127

CC-73 DCA Env Attack

0xB0, 0x49, 0xCC

Amp Env Attack Rate 0-127

CC-75 DCA Env Decay

0xB0, 0x4B, 0xCC

Amp Env Decay Rate 0-127

CC-31 DCA Env Sustain

0xB0, 0x1F, 0xCC

Amp Env Sustain Level 0-127

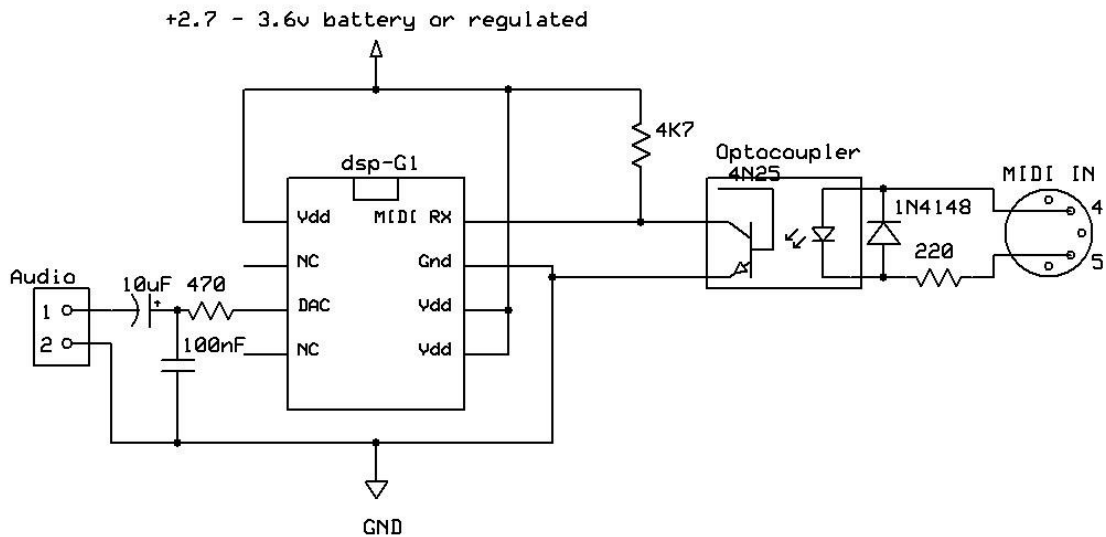
CC-72 DCA Env Release

0xB0, 0x48, 0xCC

Amp Env Release Rate 0-127

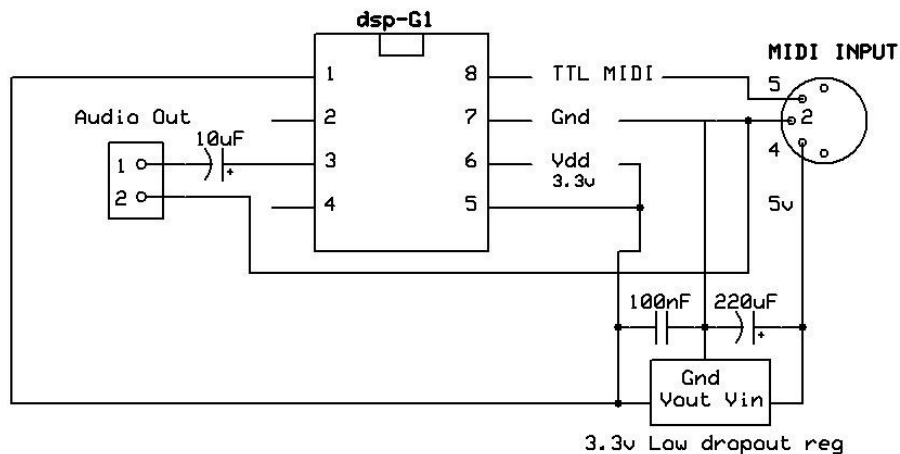
Example application circuits for the dsp-G1 chip

FULL SYNTH CIRCUIT



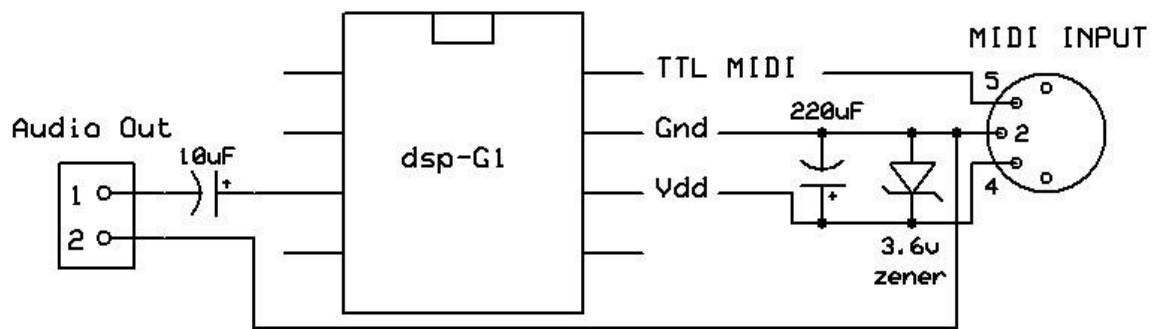
This is the full synthesizer schematic with a simple, single pole 3.3KHz anti-aliasing dac filter and an opto-coupled MIDI input. It needs to be powered by a 2.7 – 3.6v power source. Two AA batteries give 3 volts, but in most cases a 3.3v linear regulator is recommended.

MIDI Ghost Powered



This version requires no extra power but draws power from the MIDI-IN port. This doesn't work with all MIDI devices but should work with most that runs on 5v. Note that the circuit also doesn't include the anti-aliasing filter but that is easily added from the top schematics if preferred.

Zener powered



This version uses a 3.6v Zener diode for regulation. This allows it work with all MIDI devices, even the newer ones that runs on a 3.3v MCU. Note that the circuit also doesn't include the anti-aliasing filter but that is easily added from the first schematics

For any of the MIDI powered version to work Pin-2, Gnd, must be connected in the MIDI-OUT connector and MIDI cables must have a minimum of 3 wires

Technical Specifications

DSP platform	NXP 60 DMIPS
Supply power	2.7 – 3.6 volt
Supply current	~3.2mA
MIDI input	31250bps, 8 databits, 1 stopbit TTL 0 – 5volt level
Audio output	44.1KHz 16-bit sigma-delta PDM, 1 channel mono audio
Synthesis method	Virtual Analog Modeling synthesis using DSP technology
Polyphony	5 voice paraphonic
DCO	3 oscillators morphable triangle/pulse/sawwave with wrap
DCF	+24db 4-pole lowpass filter with resonance
ENV	2 envelope generators with ADSR
LFO	Low frequency oscillator with triangle and sample&hold wave
MIDI support	Note on/off, supports running status, 19 MIDI-CC parameters
MIDI channels	Fixed receive on MIDI-CH 1

Contact & Support

For support and questions please use these contact addresses:

Website: <http://www.steamsynth.com>

Email: support@steamsynth.com

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