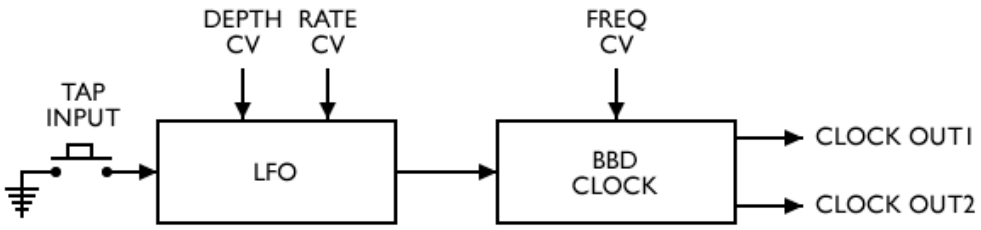
Electric Druid 4 KNOB FLANGE

Introduction

The Electric Druid 4 KNOB FLANGE flanger delay clock chip is a biphase high frequency clock suitable for driving MN32xx series bucket brigade delay lines (BBDs), combined with a wide-range LFO. All parameters are controlled by 0-5V control voltages. The chip is easy to use and helps simplify complex flanger designs.

The clock centre frequency can be adjusted with the Frequency/Manual control (FREQ CV).

The LFO has controls for the rate and depth of clock modulation (DEPTH CV and RATE CV). Additionally, the LFO can be reset to the top of the waveform using the TAP input.



Features

BBD Clock and LFO on one chip

The chip provides an LFO and a biphase BBD clock output suitable for directly driving MN32xx series bucket brigade chips on one chip. It can replace the MN3102 clock chip and the associated LFO in many modulation effects, reducing chip count and complexity.

Wide output frequency range of 20:1

The chip can produce clock frequencies from 25 to 500KHz. A wider range gives the best flanger effects.

Wide LFO range of 0.05Hz to 12Hz

The LFO provides frequencies from 0.05Hz to 12Hz. Its waveshape has been specially tweaked to provide the best sound, avoiding the abrupt changes of a triangle wave, and keeping the smoothness of a sine wave, but without the apparent "pause" at the peaks of the waveform.

Tap input to reset waveform

The chip also provides a tap input which resets the LFO to the top of the waveform so you can tap once for dramatic down-sweep effects or just to keep the LFO in time.

Fixed flanger effects

The depth of the LFO clock modulation can be turned down to zero, which allows "fixed flanger" effects (AKA "matrix filtering"). This gives a hollow, metallic sound which can be very effective on fuzzed or distorted tones.

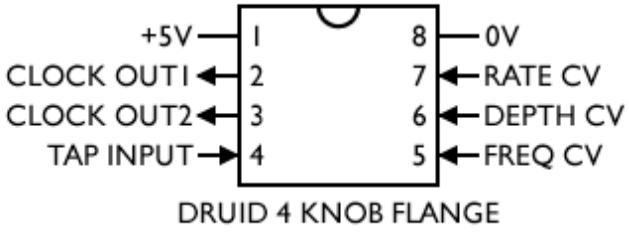
Exponential response for musical modulation

The clock modulation is exponential in character, based on octaves. This means that if you use a normal triangle wave for the LFO, you get the same smooth effect you get using a hypertriangle on a normal BBD clock. The whole point of the hypertriangle waveform is to compensate for the linear clock modulation by applying an exponential function to the triangle waveform. So if you don't use linear modulation, but rather use exponential "V/Oct" modulation, you don't need to bother with hypertriangles to get an even sweep.

The typical linear clock modulation is also the reason why chorus effects get "warbley". With linear modulation, the depth increases when the delay time gets longer. If the LFO modulates the clock by +/-25KHz around a 200KHz centre point, that's only 12% or so variation. If it does the same around a 50KHz clock (lower clock frequency equals longer delay, remember) then that +/-25KHz shifts the pitch by 50%. Keeping the modulation in the exponential world of octaves removes this problem - half an octave of mod depth is still half an octave whether it's from 50KHz or 200KHz.

The short version is our ears hear music in octaves, and musical modulation should work the same way. The 4 KNOB FLANGE chip does.

Pinout Diagram

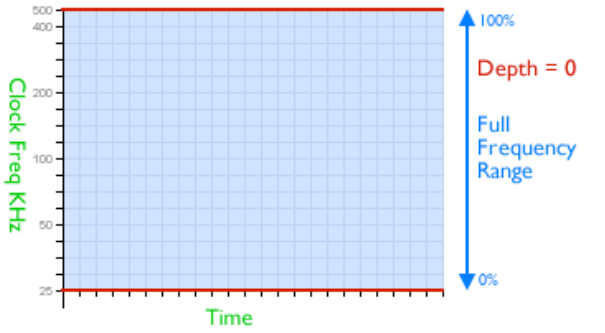


Pin	Function	Details	Notes
1	+5V	Power supply	
2	CLOCK OUT1	0-5V digital output	Biphase clock output suitable for directly driving MN3200 series BBDs
3	CLOCK OUT2	0-5V digital output	
4	TAP INPUT	0-5V digital input	Resets LFO to top of waveform Note this pin has an internal pull-up, so can be left unconnected. If used, it only requires a momentary switch to ground.
5	FREQ CV	0-5V analog input	BBD clock frequency (AKA "Manual")
6	DEPTH CV	0-5V analog input	Modulation depth (LFO->Clock) (AKA "Width")
7	RATE CV	0-5V analog input	LFO rate
8	0V	Power supply	

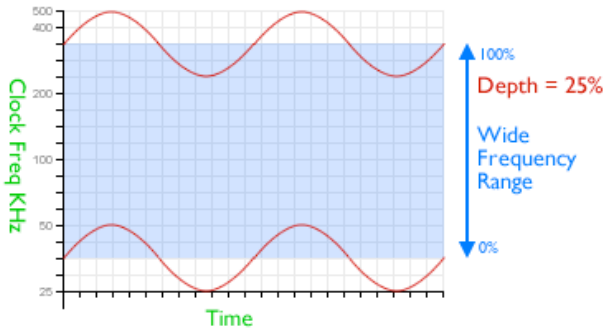
Application Notes

Interaction between "Frequency" and "Depth" controls

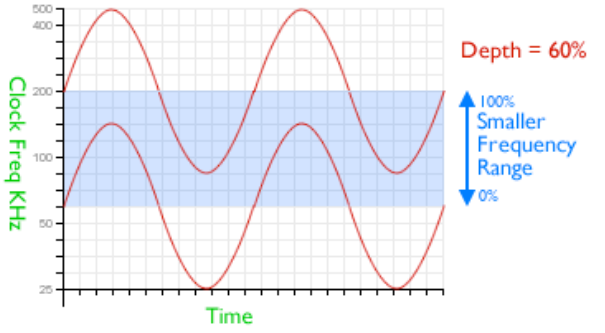
The Frequency (AKA "Manual") and Depth (AKA "Width") controls are not totally independent. The available range of Frequency adjustment depends on the position of the Depth control. As the LFO depth is increased, the available range for the Frequency control is reduced. The reason for this will become clear with a few diagrams.



At minimum depth, the LFO modulation is effectively turned off and the whole frequency range of the chip (25 to 500KHz) can be swept with the Frequency control. This gives a large range of fixed flanger sounds.

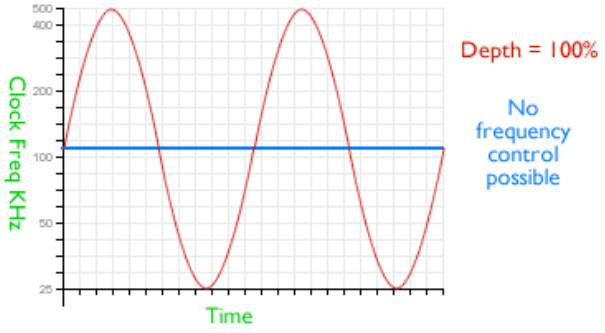


At low modulation depths, the centre position of the flanger can be swept over a wide range, allowing specific tuning of more subtle flanging sounds.



As the depth increases, the range of potential frequency adjustment decreases.

Note that the frequency control still goes from 0% to 100% - it's just that its range changes.



At maximum depth, the frequency control has no effect, since the entire range is being swept by the LFO already, and there is no room for further frequency adjustment

Delay times

The table below shows the range of delay times expected with some common lengths of BBD.

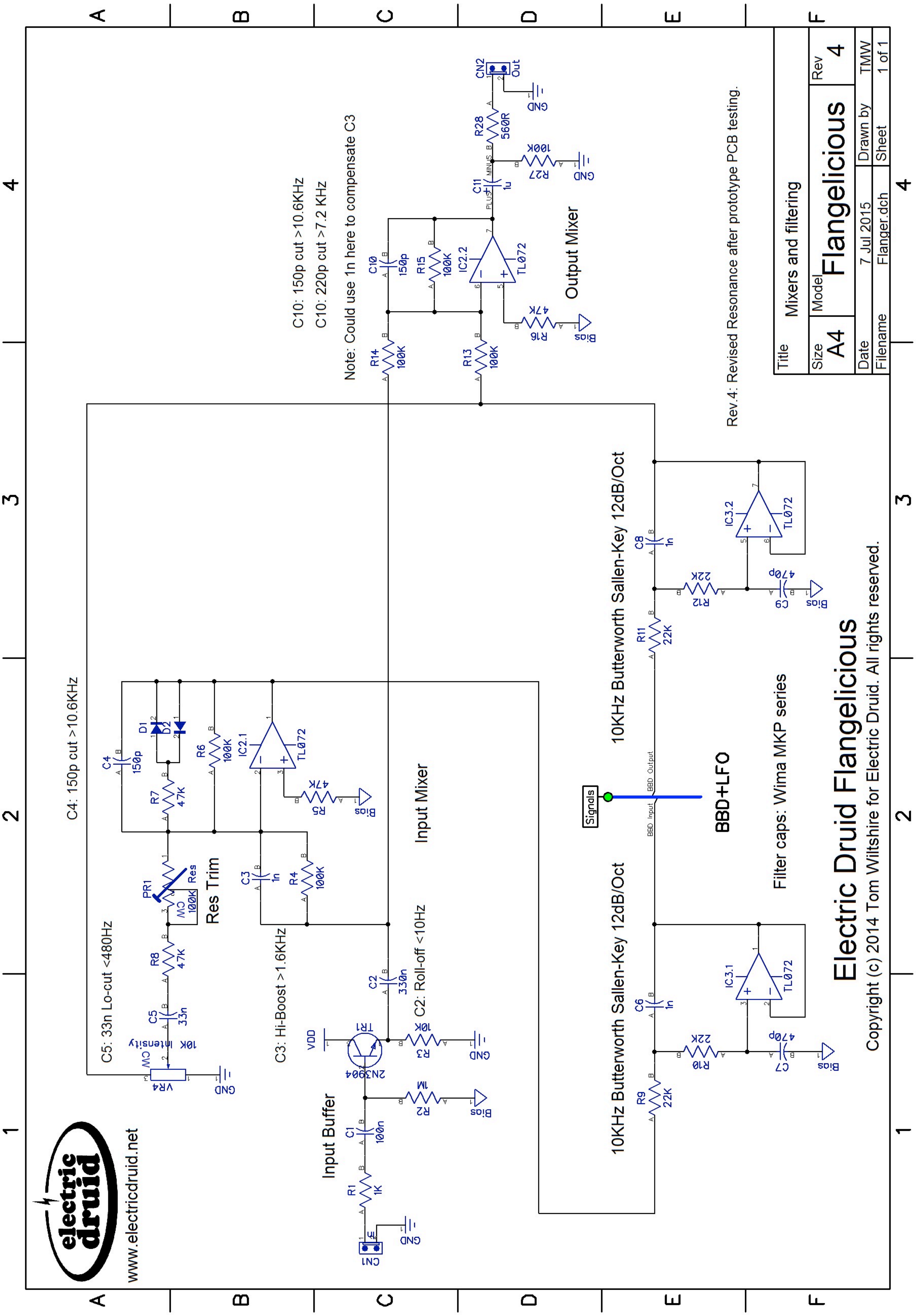
Clock Freq.	2048 stages	1024 stages	512 stages	256 stages
25 - 500KHz	40 - 2ms	20 - 1ms	10 - 0.5ms	5 - 0.25ms

Tap Input

The tap input resets the LFO to the top of its cycle when pressed. This can be used to produce a downwards sweep when required by simply tapping once.

Demonstration circuit

This demonstration circuit on the following two pages shows the features of the chip and can generate many different effects, from the lush to the loopy. PCBs for this circuit are available at http://electricdruid.net/shop


Input Buffer
Input Mixer
Output Mixer
Res Trim
C5: 33n Lo-cut <480Hz
C3: Hi-Boost >1.6KHz
C2: Roll-off <10Hz
C4: 150p cut >10.6KHz
C10: 150p cut >10.6KHz
C10: 220p cut >7.2 KHz
Note: Could use 1n here to compensate C3
10KHz Butterworth Sallen-Key 12dB/Oct
10KHz Butterworth Sallen-Key 12dB/Oct
BBD+LFO
Filter caps: Wima MKP series
Rev.4: Revised Resonance after prototype PCB testing.
Electric Druid Flangelicious
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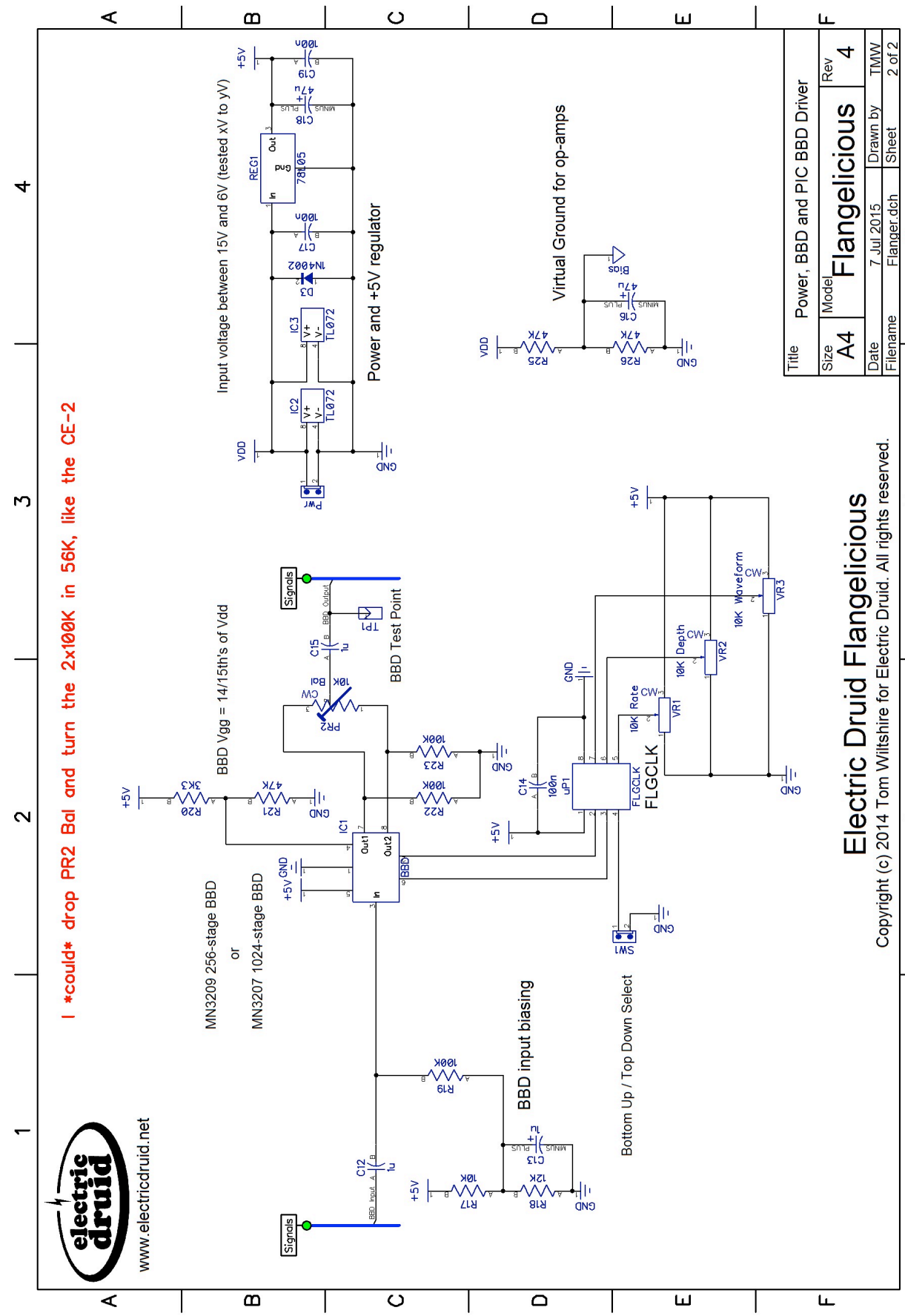
www.electricdruid.net
Title Mixers and filtering
Size A4
Model Flangelicious
Rev 4
Date 7 Jul 2015
Drawn by TMW
Filename Flanger.dch
Sheet 1 of 1


I *could* drop PR2 Bal and turn the 2x100K in 56K, like the CE-2
Input voltage between 15V and 6V (tested xV to yV)
Power and +5V regulator
Virtual Ground for op-amps
BBD Vgg = 14/15th's of Vdd
BBD Test Point
MN3209 256-stage BBD
or
MN3207 1024-stage BBD
BBD input biasing
Bottom Up / Top Down Select
FLGCLK
Title Power, BBD and PIC BBD Driver
Size A4
Model Flangelicious
Rev 4
Date 7 Jul 2015
Drawn by TMW
Filename Flanger.dch
Sheet 2 of 2
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