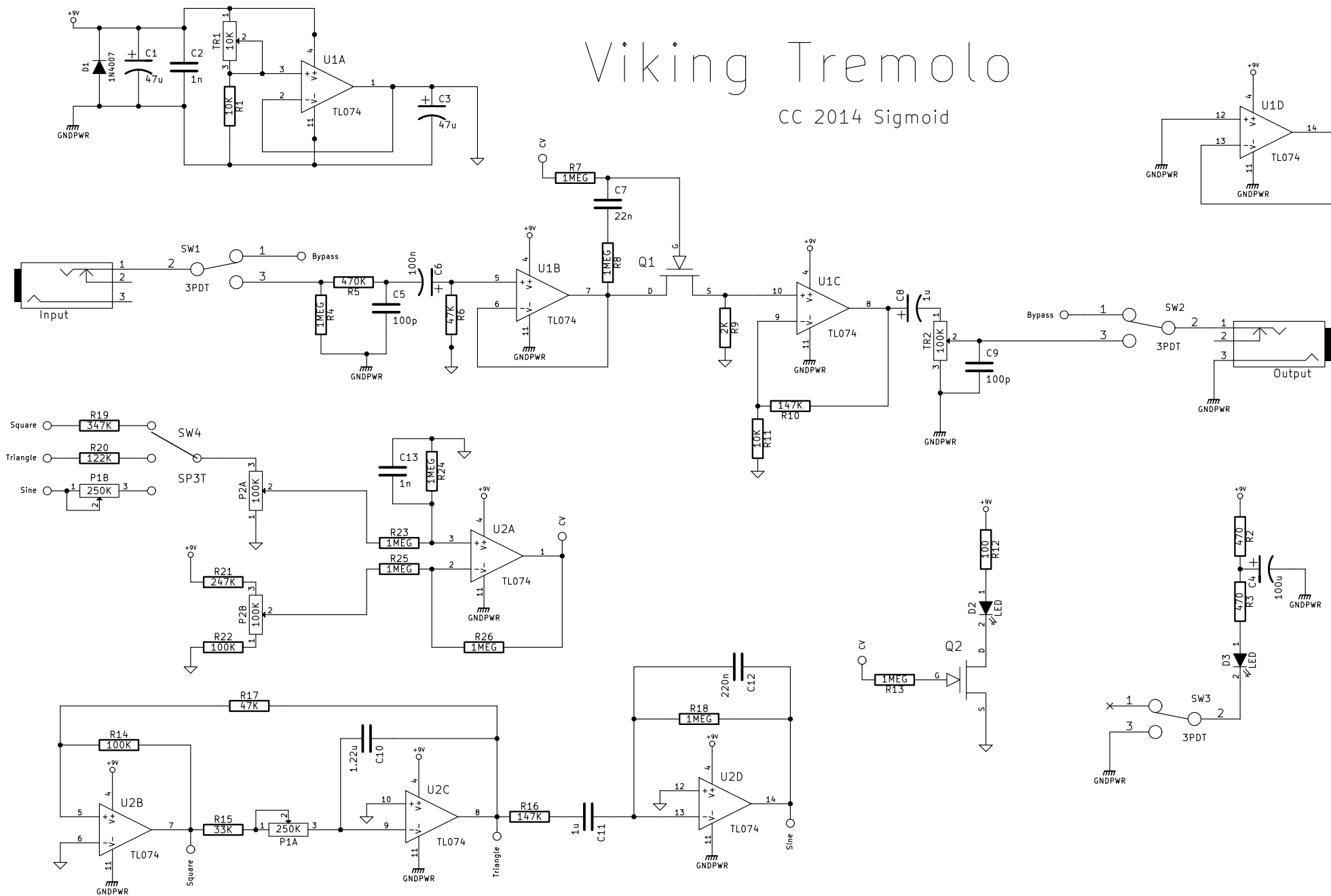


Viking Tremolo

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The Viking Tremolo features three selectable waveforms, a wide range of oscillator frequency and full depth control while maintaining the max or unattenuated volume at the bypass level across all settings. The JFET VCR follows the LFO waveform quickly and accurately unlike a LED/LDR VCR and introduces negligible distortion to the signal. The LFO is a relaxation type oscillator that generates a triangle wave, a square wave and a pseudo-sinusoidal wave. An LED gives a visual representation of the rate and depth settings.

R5 and R6 attenuate the signal to keep it within the ohmic region of the JFET. Q1 modulates volume of the signal as per the control voltage CV by acting as a voltage controlled resistor and the upper half of a voltage divider with R9. R7 and R8 linearize the resistance to gate voltage relationship by adding half of V_{ds} to the gate while C7 blocks any DC. The JFET is placed in the top of the voltage divider so that the nonlinearity of the voltage divider function approximately compensates for the human logarithmic perception of sound and the audible distortion of the control waveform that would result. U1C amplifies the signal and undoes the attenuation of R5 and R6 and trim pot TR2 fine tunes the output level to match the input. Capacitors C5, C6, C8 and C9 form bandpass filters to eliminate noise and unwanted DC voltages.

U2B and U2C act as a comparator and a ramp generator respectively and oscillate at a rate determined by potentiometer P1A which is half of the linear dual pot P1. U2D is an integrator that transforms the triangle wave of U2C into a pseudo-sinusoid. Because the output of the integrator changes with the rate of oscillation the amplitude of the pseudo-sinusoid is controlled by the other half of P1. This keeps that waveform reasonably close to constant amplitude across rate settings.

R19, R20 and the aforementioned P1B form a voltage divider with depth potentiometer P2A when selected by the SP3T switch SW4 to keep the control voltage within the correct range. P2A is part of a linear dual potentiometer with P2B. P2B sets a bias voltage for the control voltage. R21 and R22 are chosen such that when the depth is at minimum and the amplitude of the control waveform is zero the control voltage is at a value that we will call V_{on} . V_{on} is sufficiently above the pinch-off voltage of the JFET to conduct well and below the lowest likely signal level in order to avoid diode conduction in the JFET. The bias voltage is then at $-V_{on}$. When the depth is at maximum the bias voltage at the wiper of P2B is $-V_{on}$ plus half the amplitude of the control waveform. U2A is a difference amplifier that subtracts the bias voltage from the control waveform. Thus the highest part of CV is always at V_{on} while the lowest part is determined by the depth setting and falls between V_{on} and the pinch-off voltage V_{gs-off} .

Q1 and Q2 are n-channel JFETs that should have a pinch-off voltage of about -2.4v to use this schematic unmodified. I used J300Bs that I purchased from a surplus supplier. Q2 is less critical being just an indicator light circuit. Other JFETs can be used as long as the V_{gs-off} falls between V_{on} (I chose -.8v for V_{on}) and the lower saturation voltage of U2A which may be as high as 1.5v above ground. If V_{gs-off} for your device differs significantly from -2.4v then R21 and R22 will have to be adjusted as well as possibly R19, R20 and P1B with the associated changes made to P1A, R15 and C10. Trim pots can be substituted for R21 and R22. Trim pot TR1 is used to set the DC offset level at the midpoint between the output saturation levels of U2B to keep the LFO waveforms symmetrical.

C1	47u	Bill of Materials
C2	1n	
C3	47u	
C4	100u	
C5	100p	
C6	100n	
C7	22n	
C8	1u	
C9	100p	
C10	1.22u	
C11	1u	
C12	220n	
C13	1n	
D1	1N4007	
D2	LED	
D3	LED	
Pot1	250K	
Pot2	100K	
TR1	10K	
TR2	100K	
R1	10K	
R2	470	
R3	470	
R4	1MEG	
R5	470K	
R6	47K	
R7	1MEG	
R8	1MEG	
R9	2K	
R10	147K	
R11	10K	
R12	100	
R13	1MEG	
R14	100K	
R15	33K	
R16	147K	
R17	47K	
R18	1MEG	
R19	347K	
R20	122K	
R21	247K	
R22	100K	
R23	1MEG	
R24	1MEG	
R25	1MEG	
R26	1MEG	
SW1,2,3	3PDT	
SW4	SP3T	
U1	TL074	
U2	TL074	
Q1	J300B	
Q2	J300B	

Parts list by part

1.22u	1	"C10"
100	1	"R12"
100K	4	"P2A, P2B, R22, R14, TR2"
100n	1	"C6"
100p	2	"C5, C9"
100u	1	"C4"
10K	3	"R1, R11, TR1"
122K	1	"R20"
147K	2	"R10, R16"
1MEG	9	"R4, R7, R8, R13, R18, R23, R24, R25, R26"
1n	2	"C2, C13"
1N4007	1	"D1"
1u	2	"C8, C11"
220n	1	"C12"
22n	1	"C7"
247K	1	"R21"
250K	2	"P1A, P1B"
2K	1	"R9"
33K	1	"R15"
347K	1	"R19"
3PDT	1	"SW"
SP3T	1	"SW4"
470	2	"R2, R3"
47K	2	"R6, R17"
470K	1	"R5"
47u	2	"C1, C3"
J300B	1	"Q1, Q2"
LED	2	"D2, D3"
TL074	2	"U1, U2"