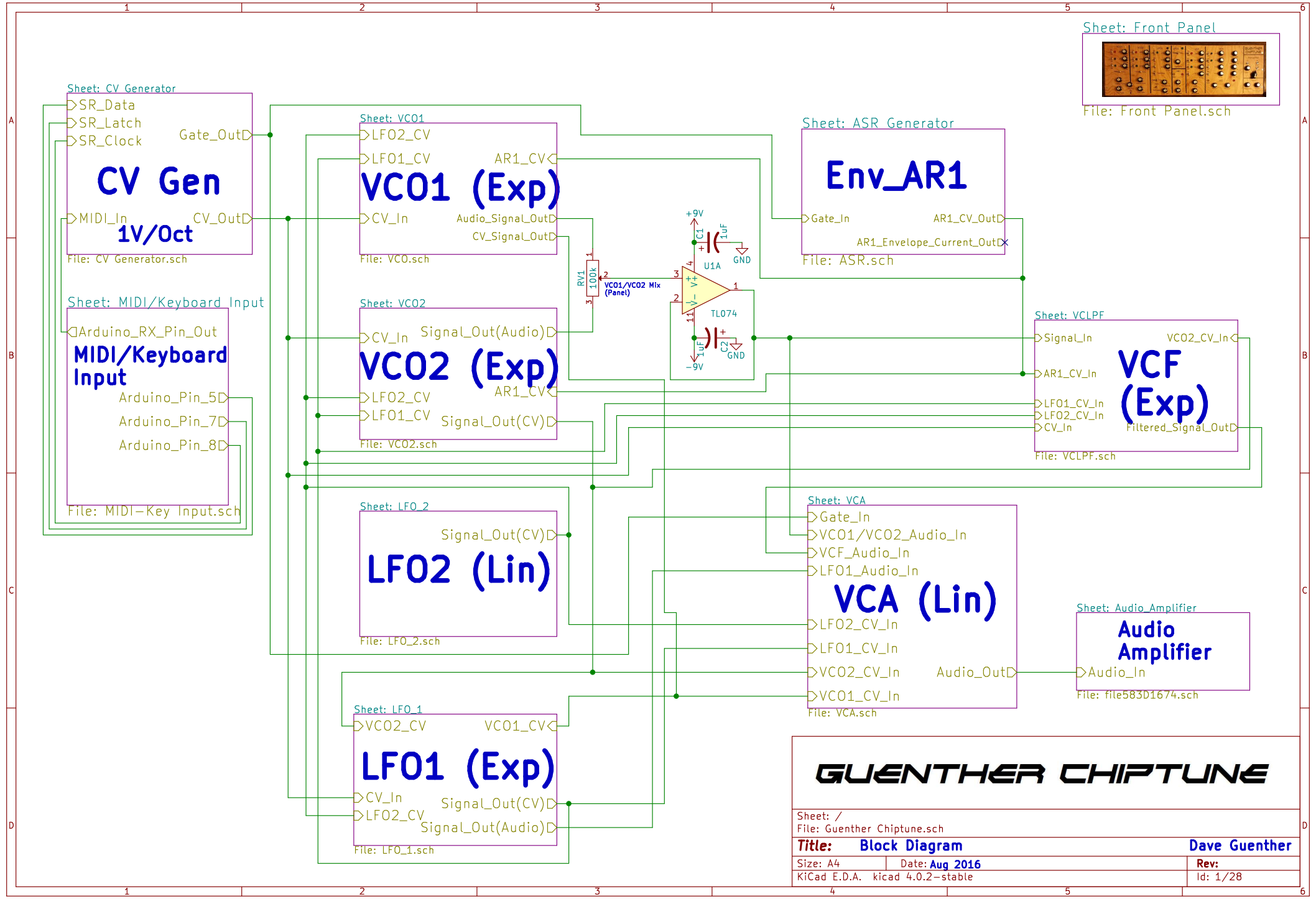
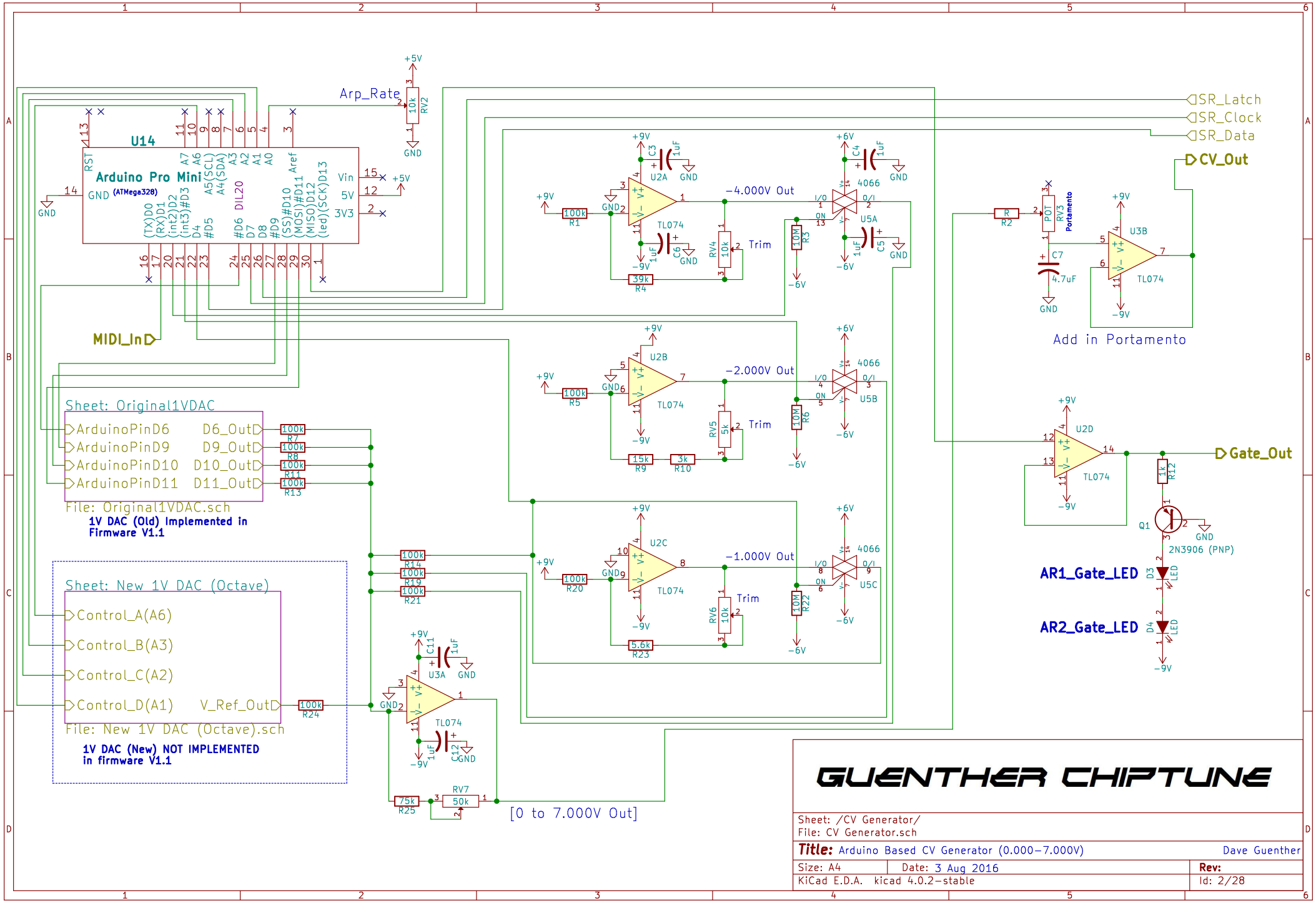
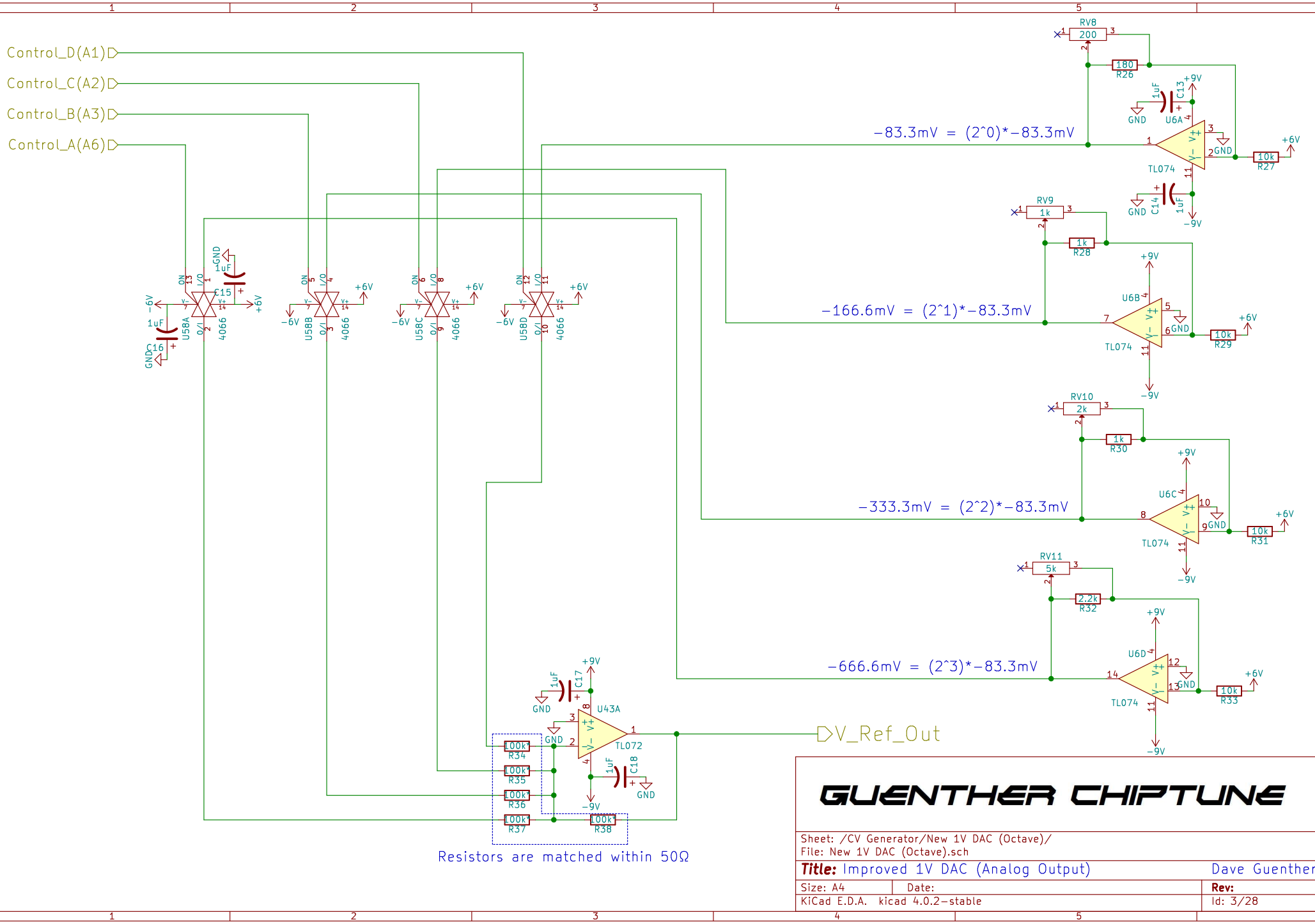
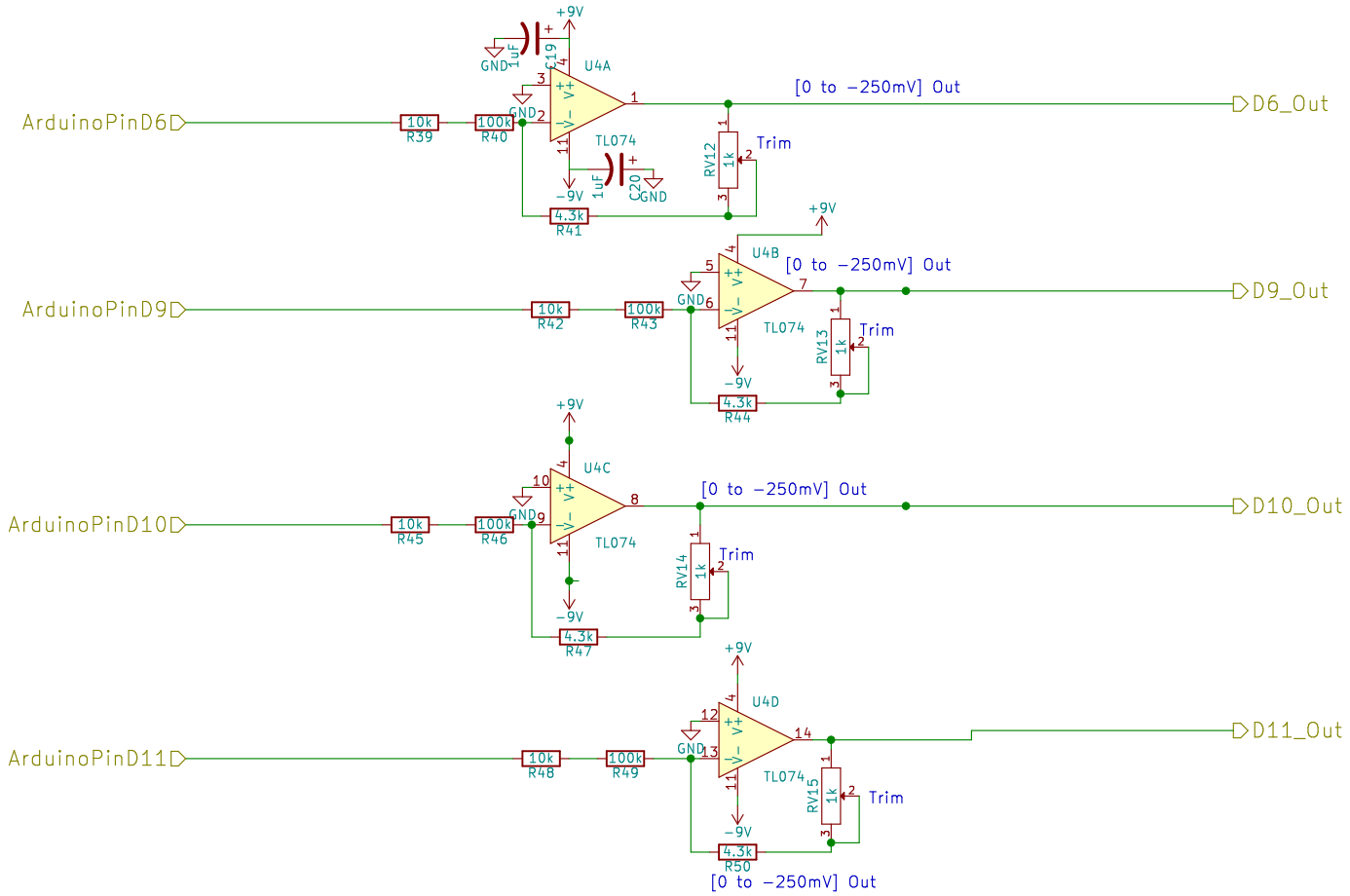
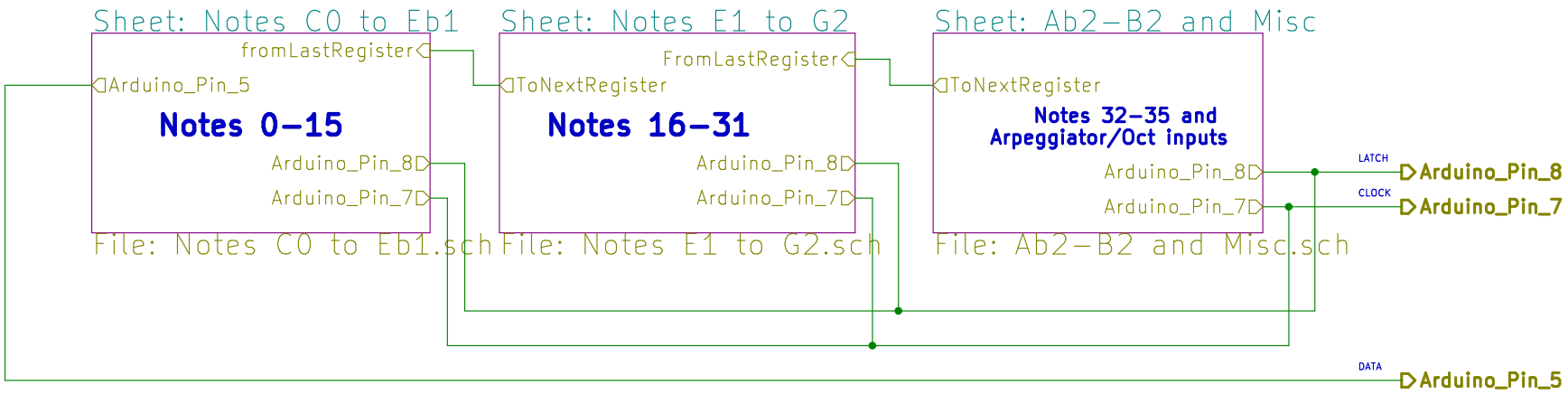

Sheet: Front Panel
File: Front Panel.sch
Sheet: CV Generator
SR_Data
SR_Latch
SR_Clock
Gate_Out
CV Gen
MIDI_In
CV_Out
1V/Oct
File: CV Generator.sch
Sheet: MIDI/Keyboard Input
Arduino_RX_Pin_Out
MIDI/Keyboard Input
Arduino_Pin_5
Arduino_Pin_7
Arduino_Pin_8
File: MIDI-Key Input.sch
Sheet: VCO1
LFO2_CV
LFO1_CV
AR1_CV
VCO1 (Exp)
CV_In
Audio_Signal_Out
CV_Signal_Out
File: VCO.sch
Sheet: VCO2
CV_In
Signal_Out(Audio)
VCO2 (Exp)
LFO2_CV
AR1_CV
LFO1_CV
Signal_Out(CV)
File: VCO2.sch
Sheet: LFO_2
Signal_Out(CV)
LFO2 (Lin)
File: LFO_2.sch
Sheet: LFO_1
VCO2_CV
VCO1_CV
LFO1 (Exp)
CV_In
LFO2_CV
Signal_Out(CV)
Signal_Out(Audio)
File: LFO_1.sch
Sheet: ASR Generator
Env_AR1
Gate_In
AR1_CV_Out
AR1_Envelope_Current_Out
File: ASR.sch
RV1
100k
VCO1/VCO2 Mix (Panel)
+9V
C1
1uF
GND
U1A
TL074
C2
-9V
Sheet: VCLPF
Signal_In
VCO2_CV_In
AR1_CV_In
VCF (Exp)
LFO1_CV_In
LFO2_CV_In
CV_In
Filtered_Signal_Out
File: VCLPF.sch
Sheet: VCA
Gate_In
VCO1/VCO2_Audio_In
VCF_Audio_In
LFO1_Audio_In
VCA (Lin)
LFO2_CV_In
LFO1_CV_In
VCO2_CV_In
VCO1_CV_In
Audio_Out
File: VCA.sch
Sheet: Audio_Amplifier
Audio Amplifier
Audio_In
File: file583D1674.sch
GUENTHER CHIPTUNE
Sheet: /
File: Guenther Chiptune.sch
Title: Block Diagram
Dave Guenther
Size: A4
Date: Aug 2016
Rev:
KiCad E.D.A. kicad 4.0.2-stable
Id: 1/28

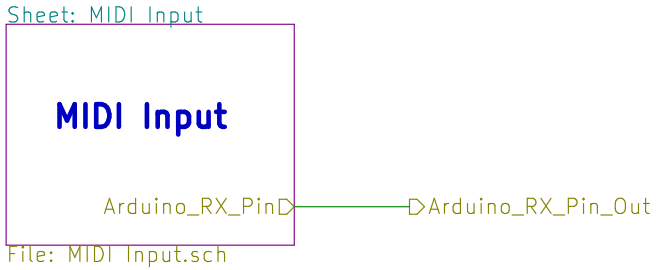

Arp_Rate
RV2
10k
+5V
GND
U14
Arduino Pro Mini
(ATMega328)
MIDI_In
SR_Latch
SR_Clock
SR_Data
CV_Out
Gate_Out
U2A
U2B
U2C
U2D
U3A
U3B
U5A
U5B
U5C
4066
TL074
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R19
R20
R21
R22
R23
R24
R25
RV3
RV4
RV5
RV6
RV7
C3
C4
C5
C6
C7
C11
C12
Trim
Portamento
Add in Portamento
−4.000V Out
−2.000V Out
−1.000V Out
[0 to 7.000V Out]
Q1
2N3906 (PNP)
D3
D4
LED
AR1_Gate_LED
AR2_Gate_LED
Sheet: Original1VDAC
ArduinoPinD6
ArduinoPinD9
ArduinoPinD10
ArduinoPinD11
D6_Out
D9_Out
D10_Out
D11_Out
File: Original1VDAC.sch
1V DAC (Old) Implemented in Firmware V1.1
Sheet: New 1V DAC (Octave)
Control_A(A6)
Control_B(A3)
Control_C(A2)
Control_D(A1)
V_Ref_Out
File: New 1V DAC (Octave).sch
1V DAC (New) NOT IMPLEMENTED in firmware V1.1
GUENTHER CHIPTUNE
Sheet: /CV Generator/
File: CV Generator.sch
Title: Arduino Based CV Generator (0.000−7.000V)
Dave Guenther
Size: A4
Date: 3 Aug 2016
Rev:
KiCad E.D.A. kicad 4.0.2−stable
Id: 2/28


Control_D(A1)
Control_C(A2)
Control_B(A3)
Control_A(A6)
-83.3mV = (2^0)*-83.3mV
-166.6mV = (2^1)*-83.3mV
-333.3mV = (2^2)*-83.3mV
-666.6mV = (2^3)*-83.3mV
V_Ref_Out
RV8
200
180
R26
RV9
1k
1k
R28
RV10
2k
1k
R30
RV11
5k
2.2k
R32
10k
R27
10k
R29
10k
R31
10k
R33
TL074
U6A
U6B
U6C
U6D
U58A
U58B
U58C
U58D
4066
U43A
TL072
100k
R34
R35
R36
R37
R38
C13
C14
C15
C16
C17
C18
1uF
+9V
-9V
+6V
-6V
GND
Resistors are matched within 50Ω
GUENTHER CHIPTUNE
Sheet: /CV Generator/New 1V DAC (Octave)/
File: New 1V DAC (Octave).sch
Title: Improved 1V DAC (Analog Output)
Dave Guenther
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 4.0.2-stable
Id: 3/28



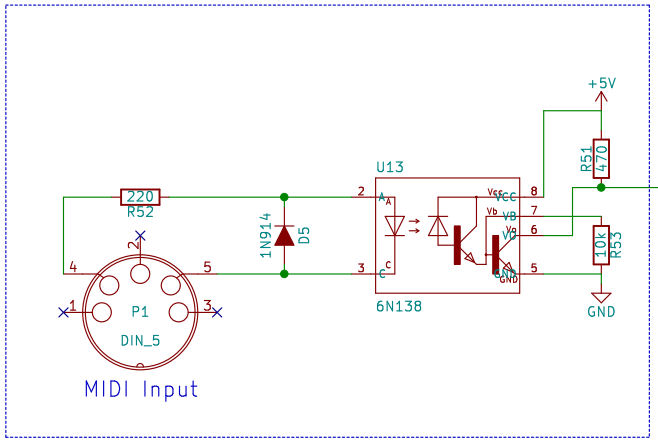
Sheet: /CV Generator/Original1VDAC/		
File: Original1VDAC.sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 4.0.2-stable		Id: 4/28





GUENTHER CHIPTUNE

Sheet: /MIDI/Keyboard Input/ File: MIDI–Key Input.sch		
Title: MIDI and Keyboard Input		Dave Guenther
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 4.0.2–stable		Id: 5/28



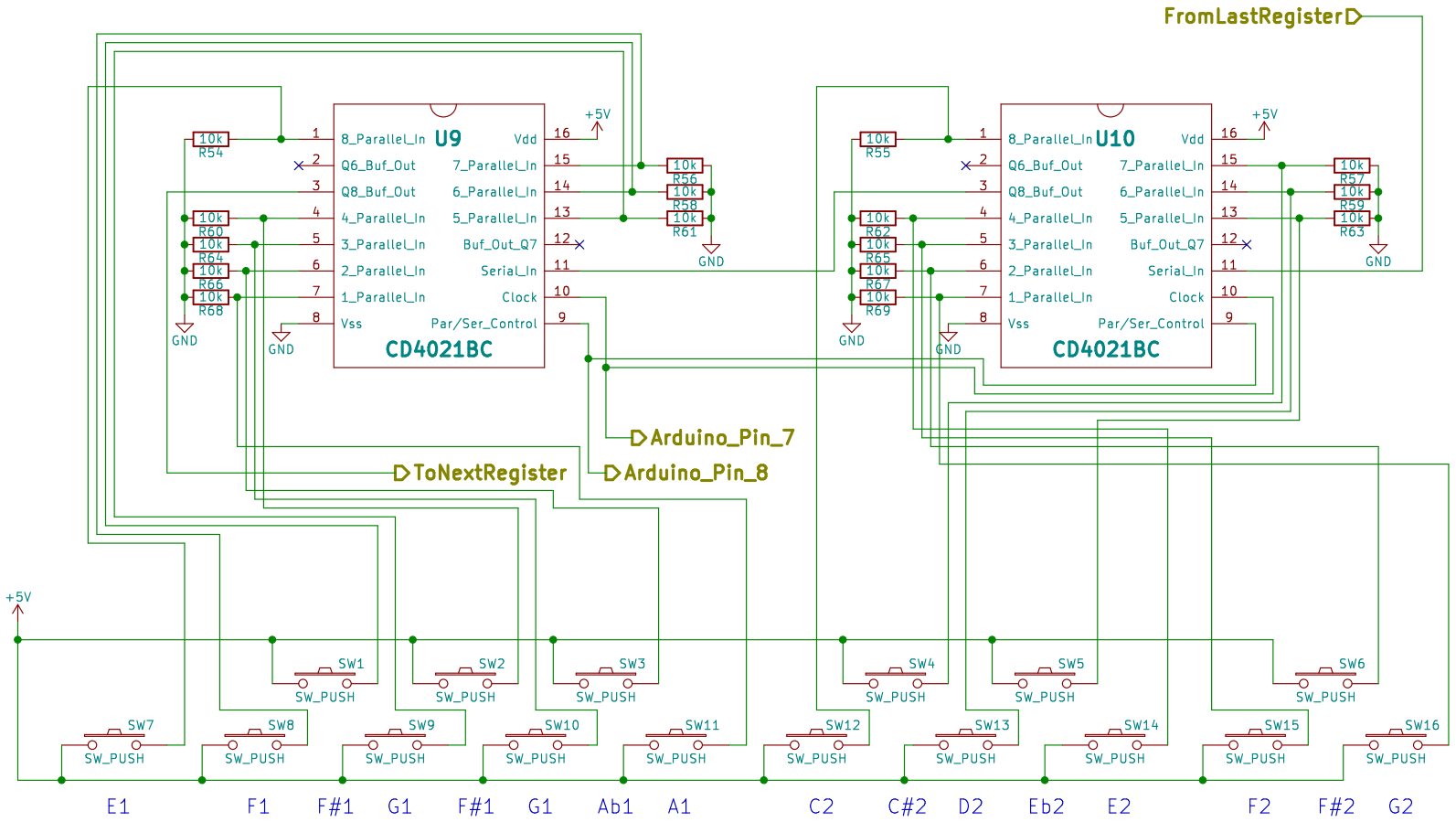
MIDI Input schematic based on Instructable by Amanda Ghassaei
http://www.instructables.com/id/Send-and-Receive-MIDI-with-Arduino/

GUENTHER CHIPTUNE

Sheet: /MIDI/Keyboard Input/MIDI Input/
File: MIDI Input.sch

Title: MIDI Input from Computer/Controller — Dave Guenther

Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 4.0.2-stable		Id: 6/28

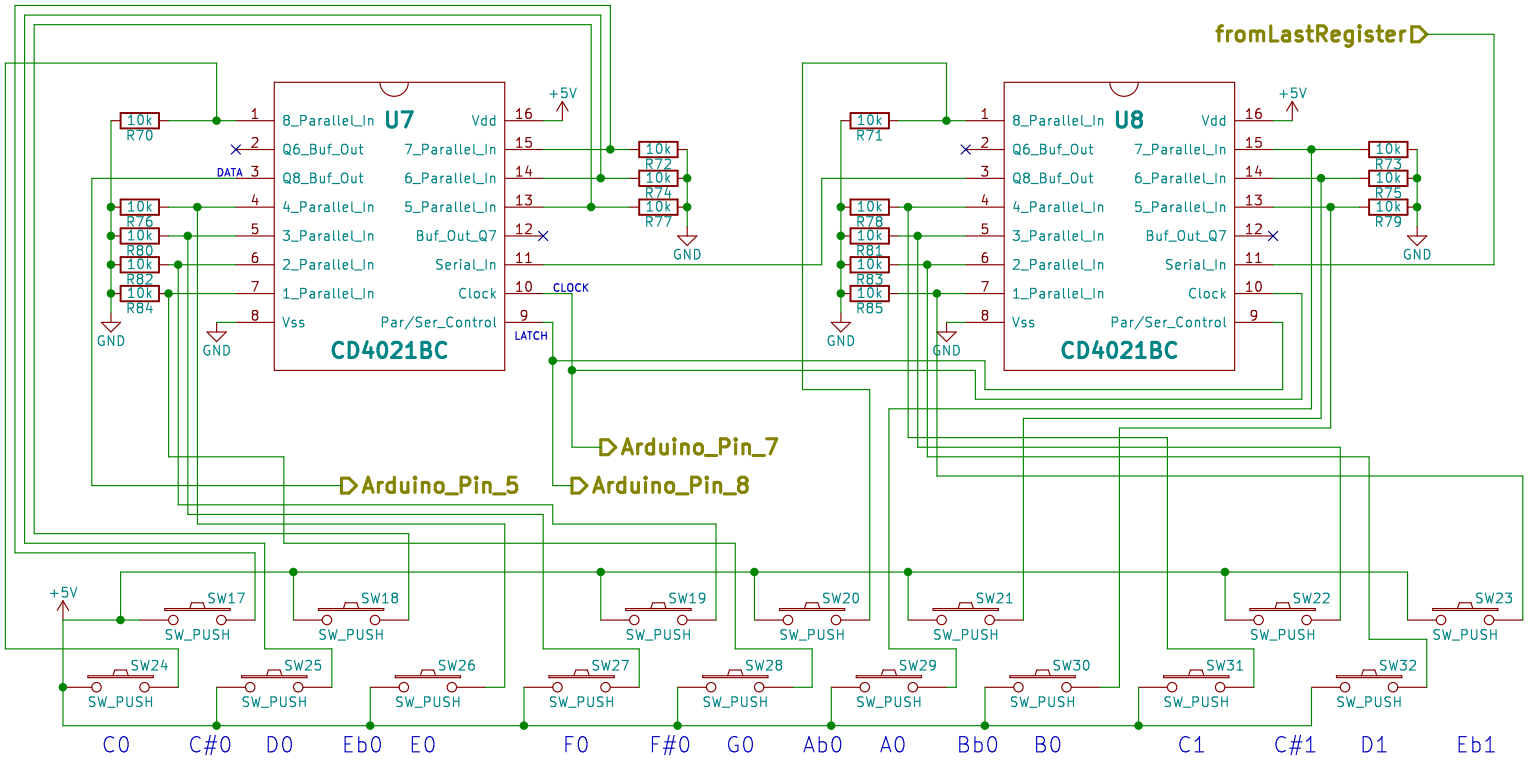


GUENTHER CHIPTUNE

Sheet: /MIDI/Keyboard Input/Notes E1 to G2/
File: Notes E1 to G2.sch

Title: Notes E1 to G2 (2 Shift Registers)

Size: A4	Date:	Rev:
KiCad E.D.A. kicad 4.0.2-stable		Id: 7/28

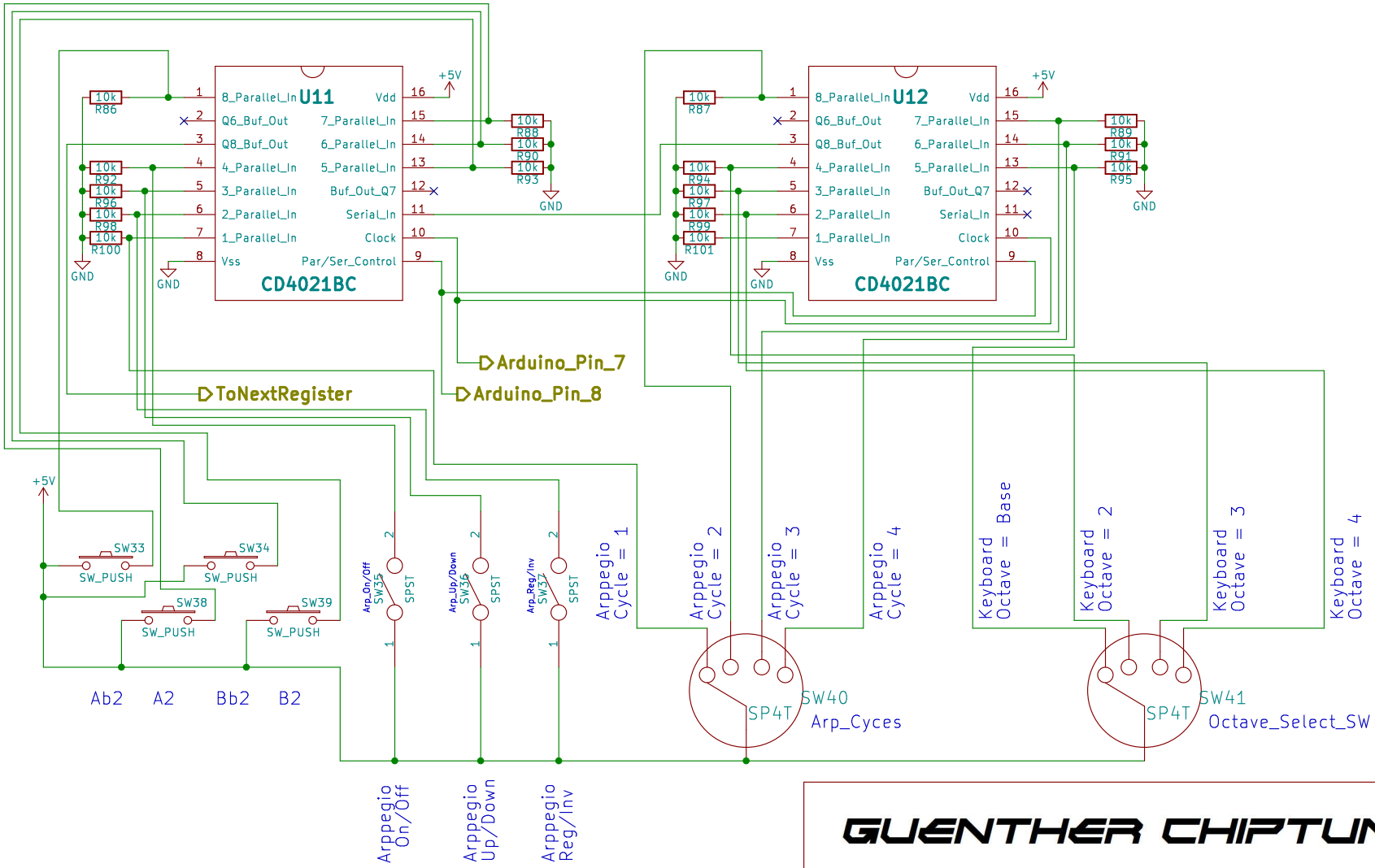


GUENTHER CHIPTUNE

Sheet: /MIDI/Keyboard Input/Notes C0 to Eb1/
File: Notes C0 to Eb1.sch

Title: Notes C0 to Eb1 (2 Shift Registers) Dave Guenther

Size: A4	Date:	Rev:
KiCad E.D.A. kicad 4.0.2-stable		Id: 8/28

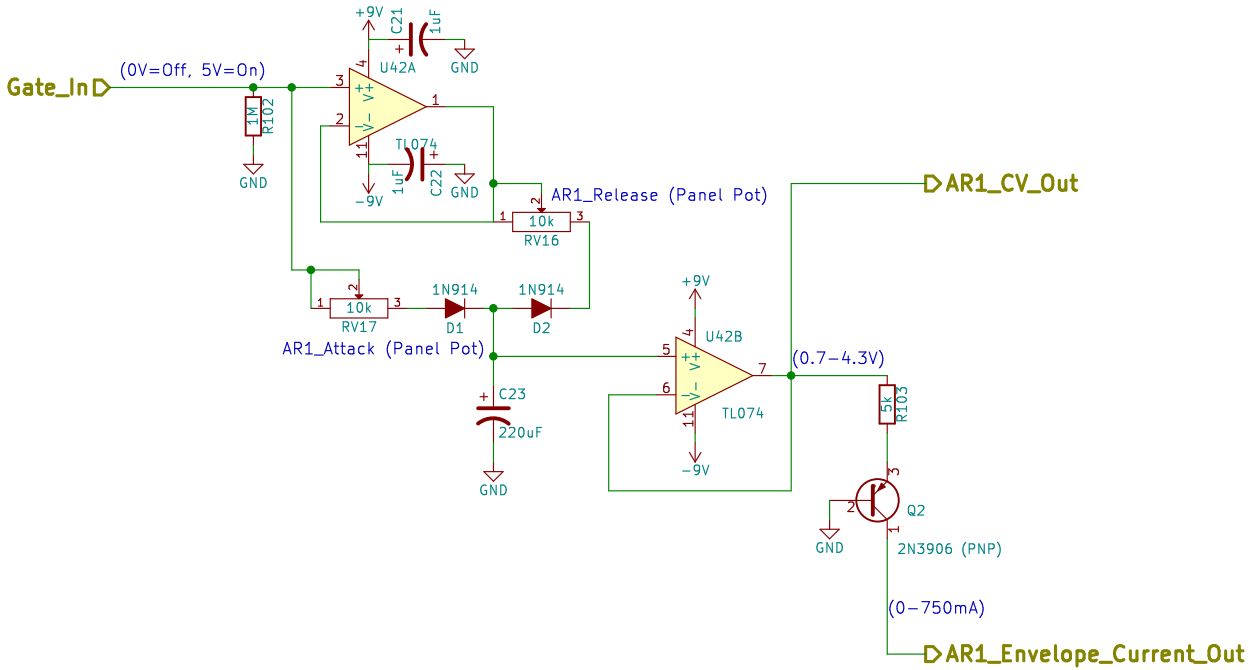


GUENTHER CHIPTUNE

Sheet: /MIDI/Keyboard Input/Ab2–B2 and Misc/
File: Ab2–B2 and Misc.sch

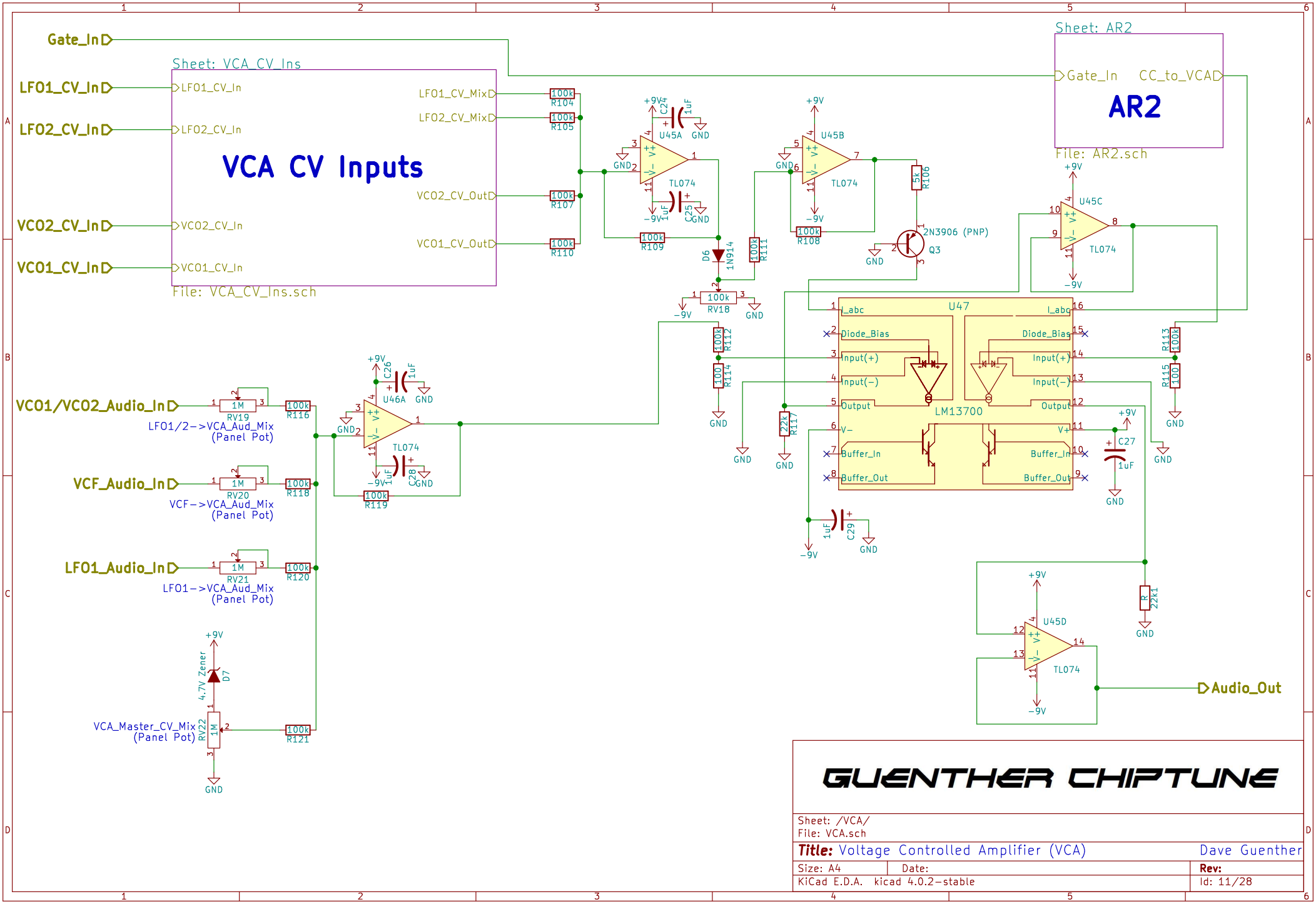
Title: Notes Ab2 to B2, Arp and Octave Controls — Dave Guenther

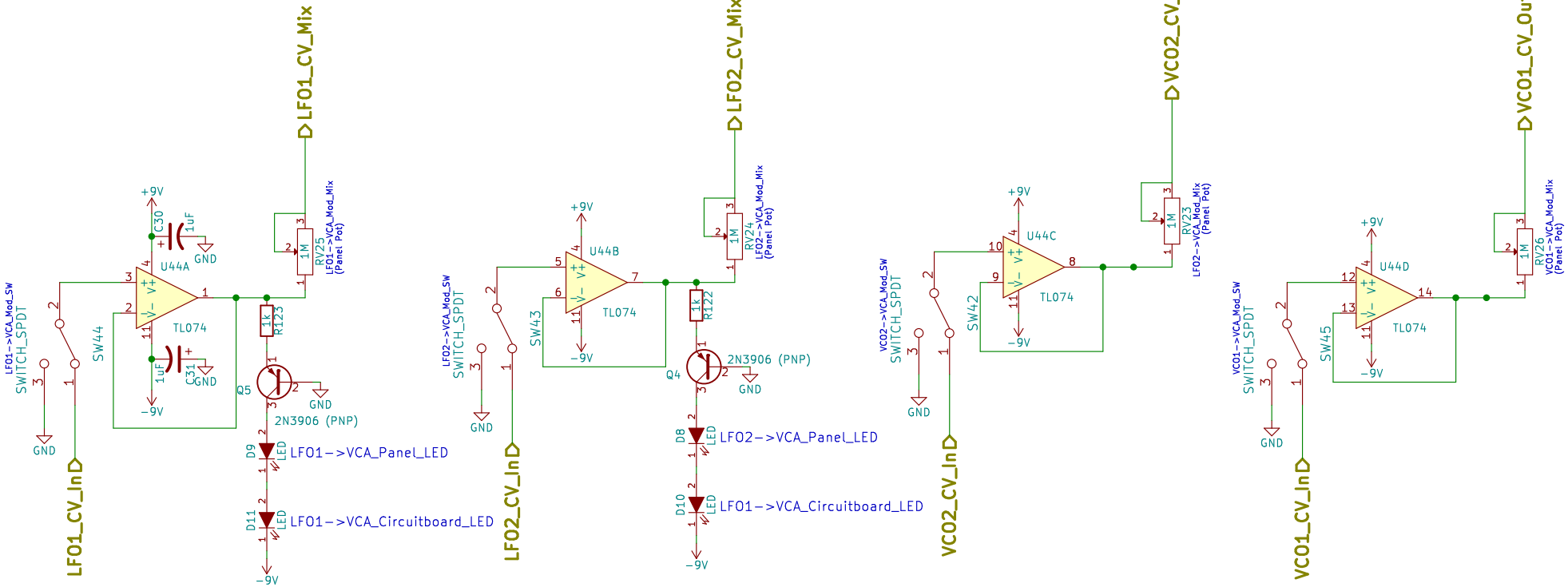
Size: A4	Date:	Rev:
KiCad E.D.A. kicad 4.0.2-stable		Id: 9/28



GUENTHER CHIPTUNE

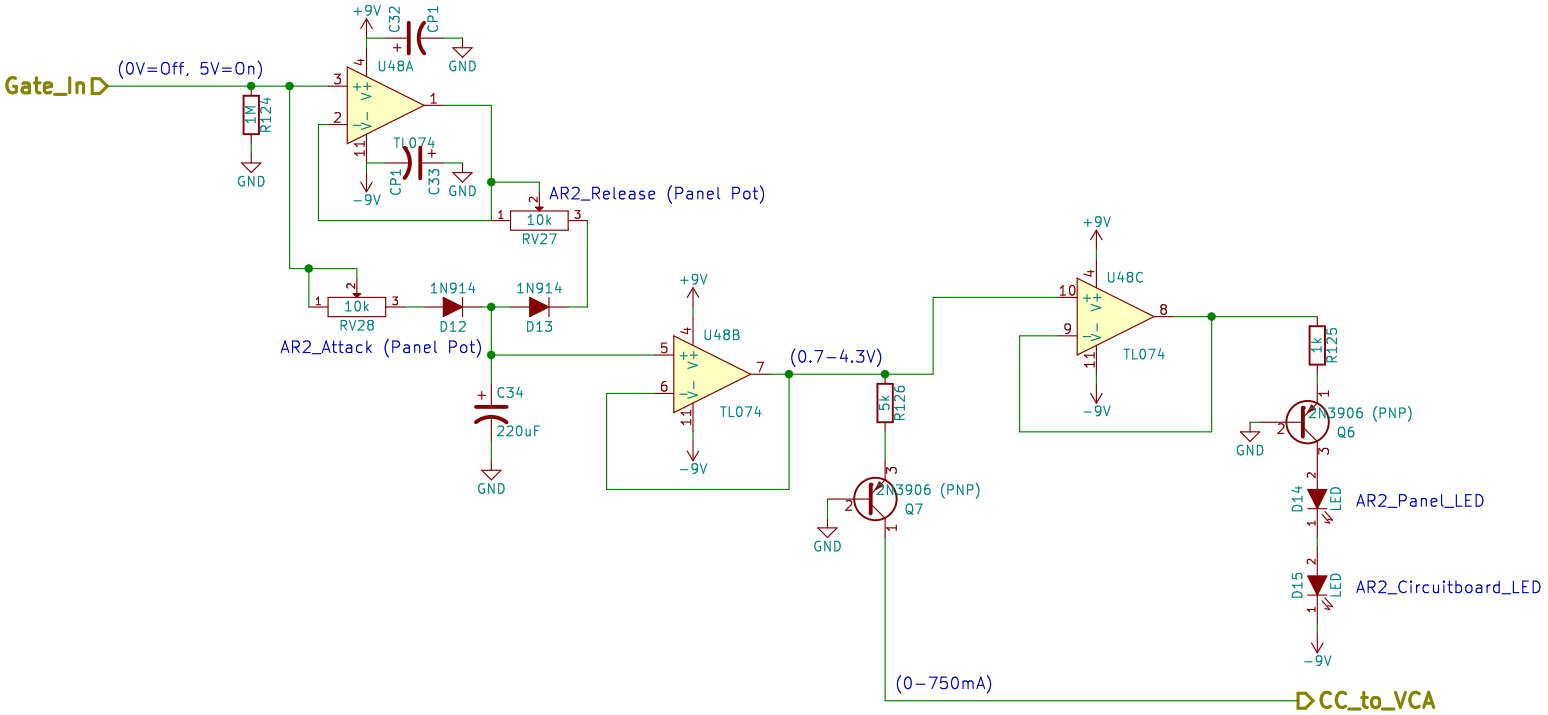
Sheet: /ASR Generator/ File: ASR.sch	
Title: Attack Release (AR) Generator 1	Dave Guenther
Size: A4 Date:	**Rev:**
KiCad E.D.A. kicad 4.0.2-stable	Id: 10/28


Gate_In
Sheet: VCA_CV_Ins
LFO1_CV_In
LFO2_CV_In
VCO2_CV_In
VCO1_CV_In
VCA CV Inputs
LFO1_CV_In
LFO2_CV_In
VCO2_CV_In
VCO1_CV_In
LFO1_CV_Mix
LFO2_CV_Mix
VCO2_CV_Out
VCO1_CV_Out
File: VCA_CV_Ins.sch
Sheet: AR2
Gate_In
CC_to_VCA
AR2
File: AR2.sch
VCO1/VCO2_Audio_In
LFO1/2->VCA_Aud_Mix
(Panel Pot)
VCF_Audio_In
VCF->VCA_Aud_Mix
(Panel Pot)
LFO1_Audio_In
LFO1->VCA_Aud_Mix
(Panel Pot)
VCA_Master_CV_Mix
(Panel Pot)
4.7V Zener
U47
LM13700
TL074
2N3906 (PNP)
1N914
Audio_Out
GUENTHER CHIPTUNE
Sheet: /VCA/
File: VCA.sch
Title: Voltage Controlled Amplifier (VCA)
Dave Guenther
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 4.0.2-stable
Id: 11/28



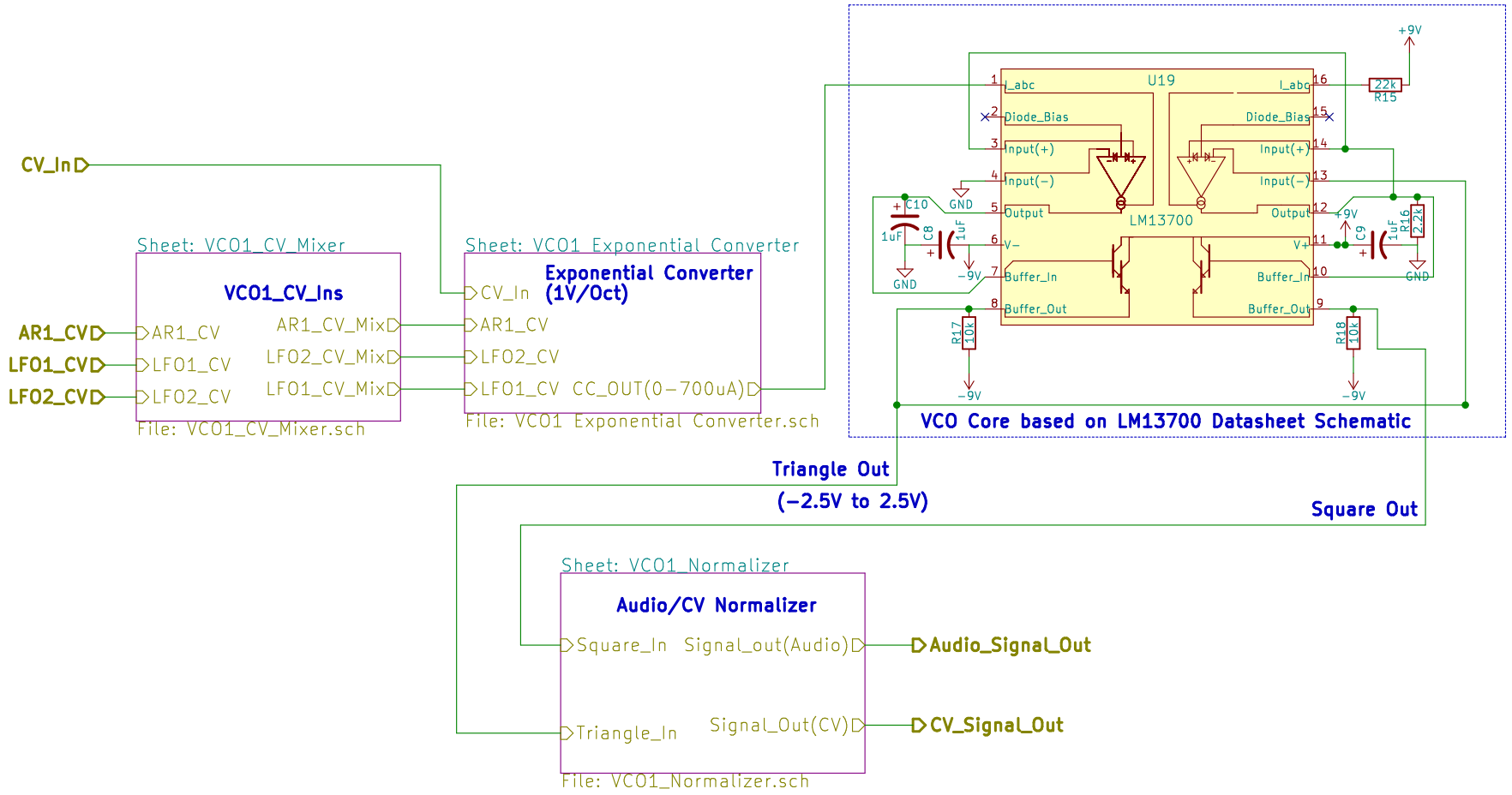
GUENTHER CHIPTUNE

Sheet: /VCA/VCA_CV_Ins/	
File: VCA_CV_Ins.sch	
Title: VCA CV Input Mixer	Dave Guenther
Size: A4 Date:	**Rev:**
KiCad E.D.A. kicad 4.0.2-stable	Id: 12/28



GUENTHER CHIPTUNE

Sheet: /VCA/AR2/ File: AR2.sch		
Title: Attack Release (AR) 2 Generator		Dave Guenther
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 4.0.2-stable		Id: 13/28



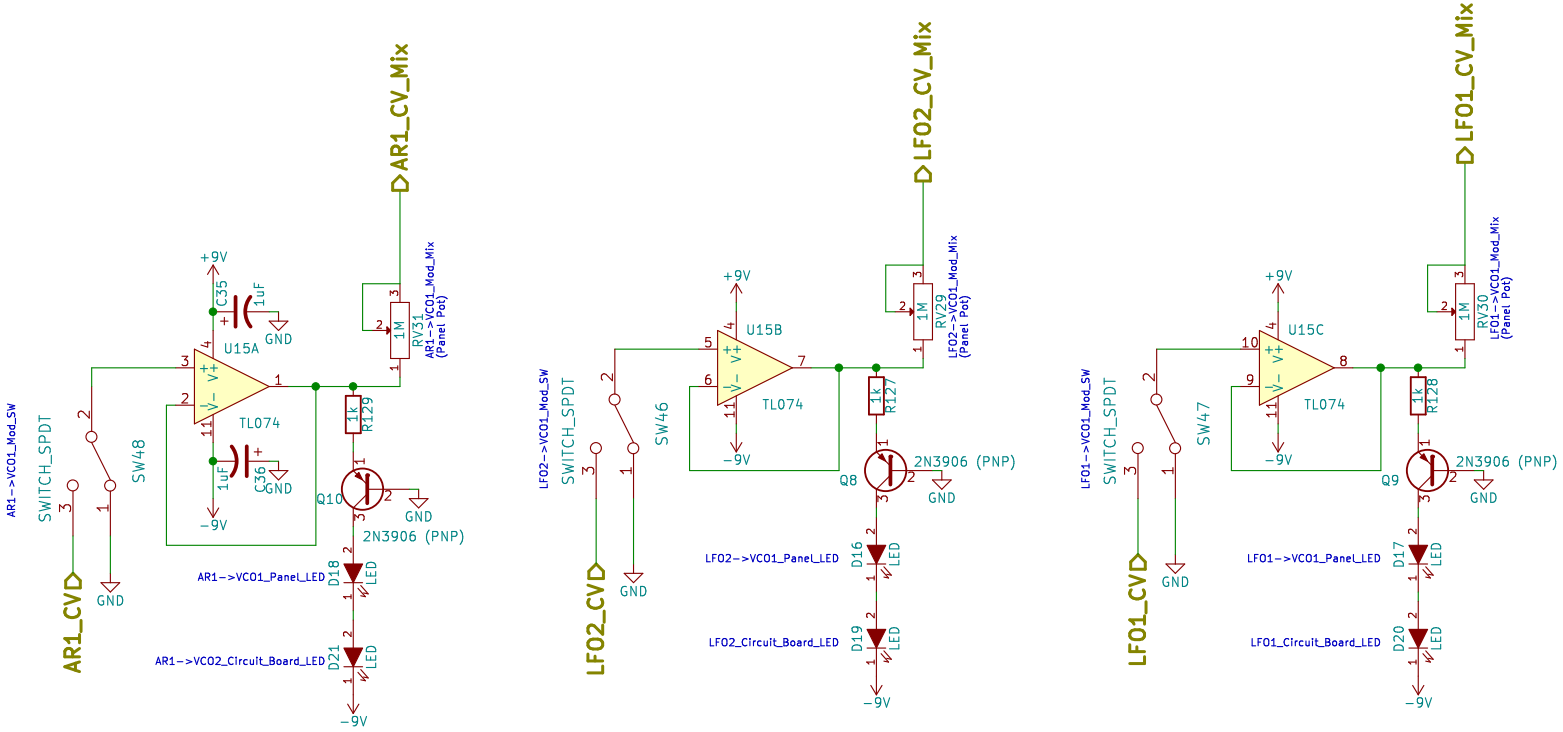
GUENTHER CHIPTUNE

Sheet: /VCO1/
File: VCO.sch

Title: LM13700 VCO Square-Tri Core (1V/Oct)

Dave Guenther, 2016

Size: USLetter	Date: 5/30/2016	Rev:
KiCad E.D.A. kicad 4.0.2-stable		Id: 14/28

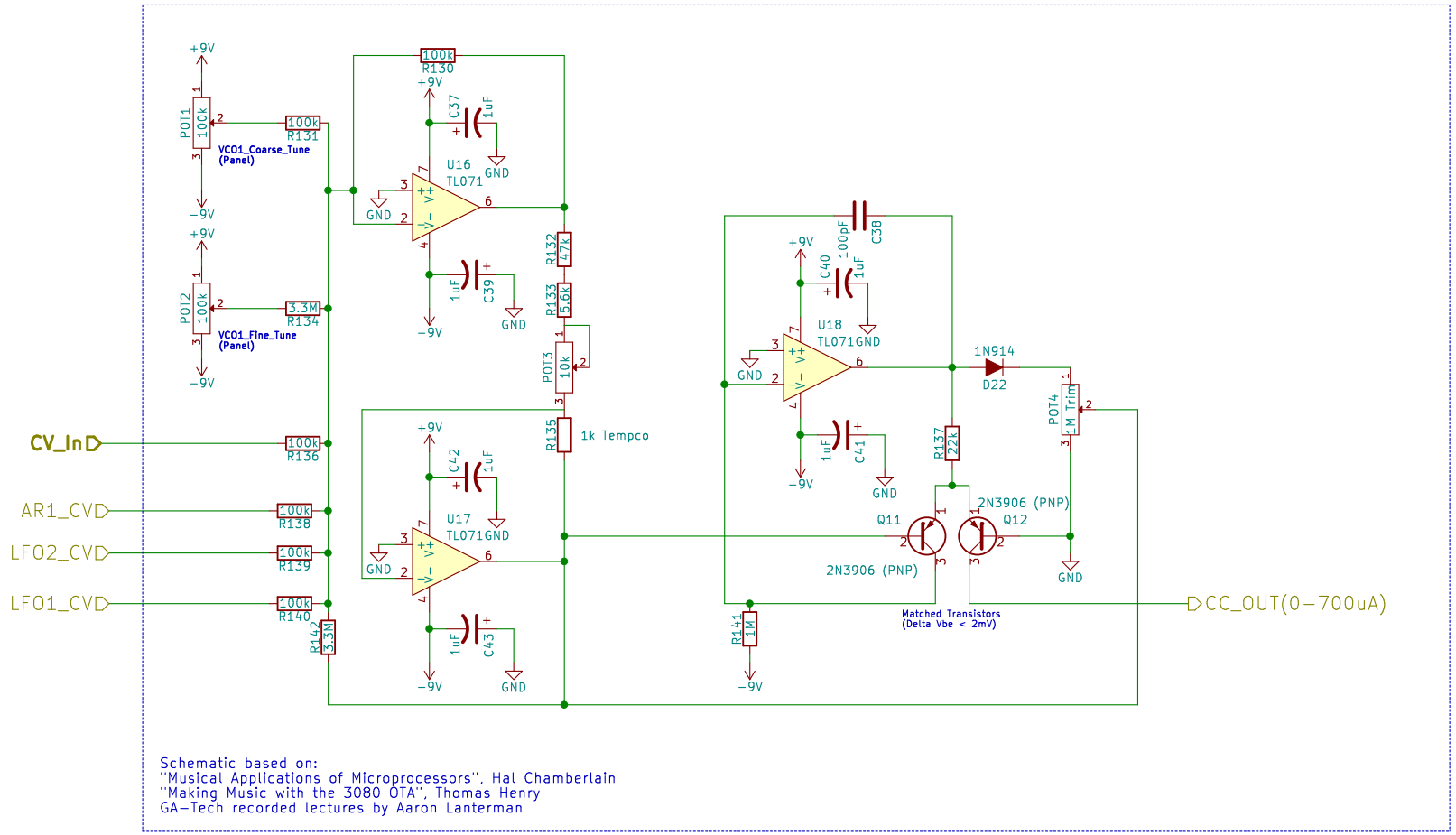


GUENTHER CHIPTUNE

Sheet: /VCO1/VCO1_CV_Mixer/
File: VCO1_CV_Mixer.sch

Title: VCO1 CV Mixer — Dave Guenther 2016

Size: USLetter	Date:	**Rev:**
KiCad E.D.A. kicad 4.0.2-stable		Id: 15/28

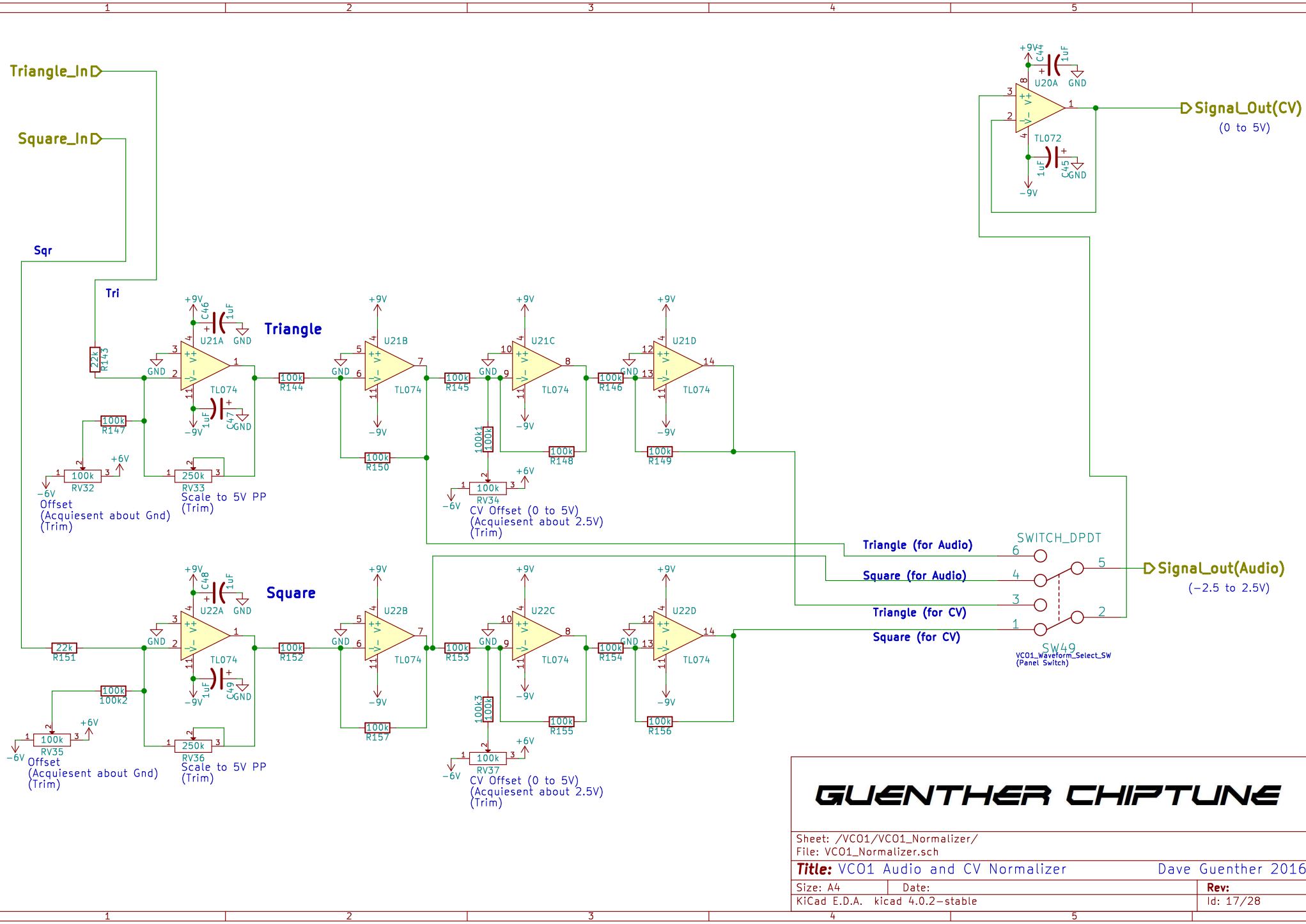


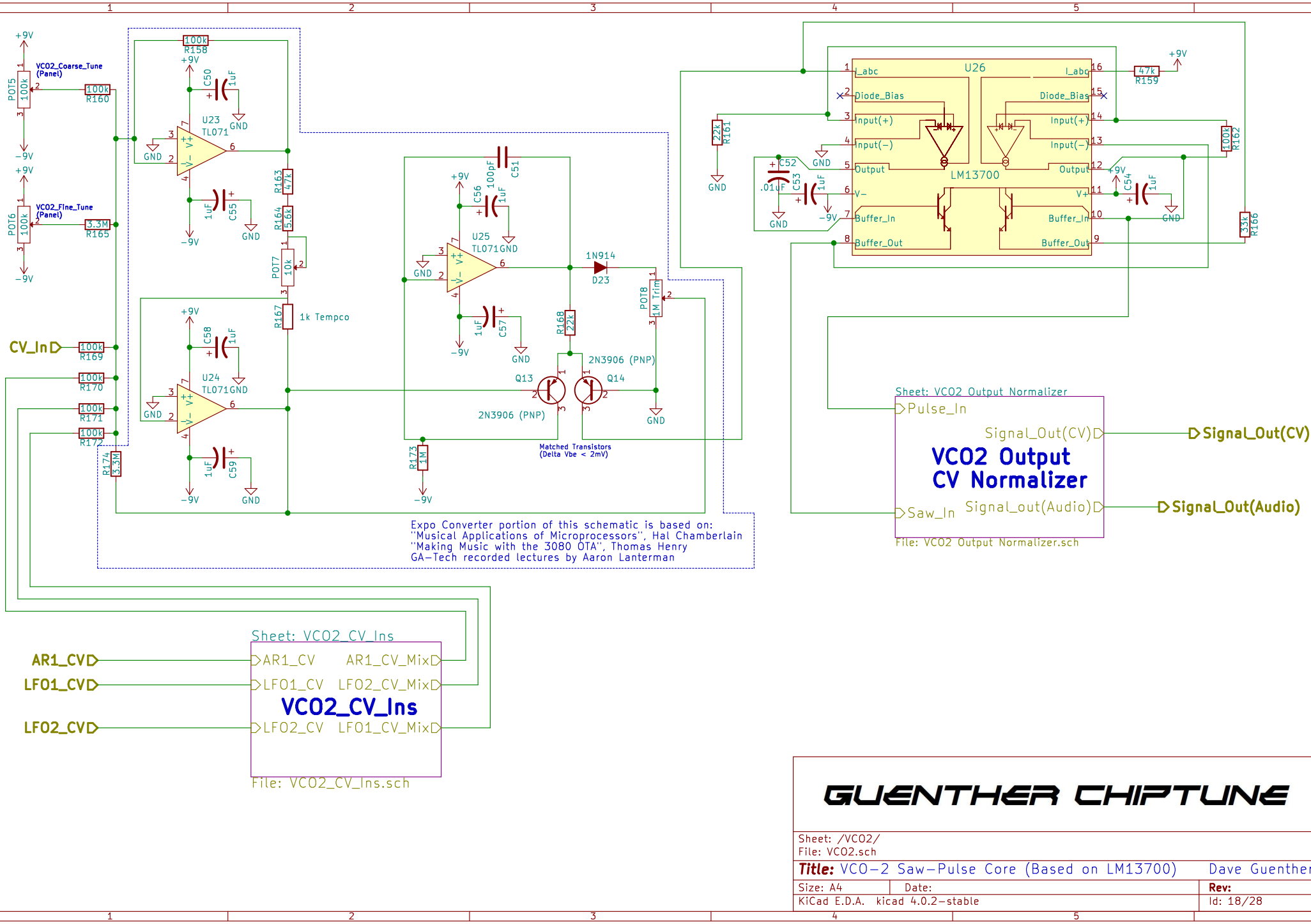
GUENTHER CHIPTUNE

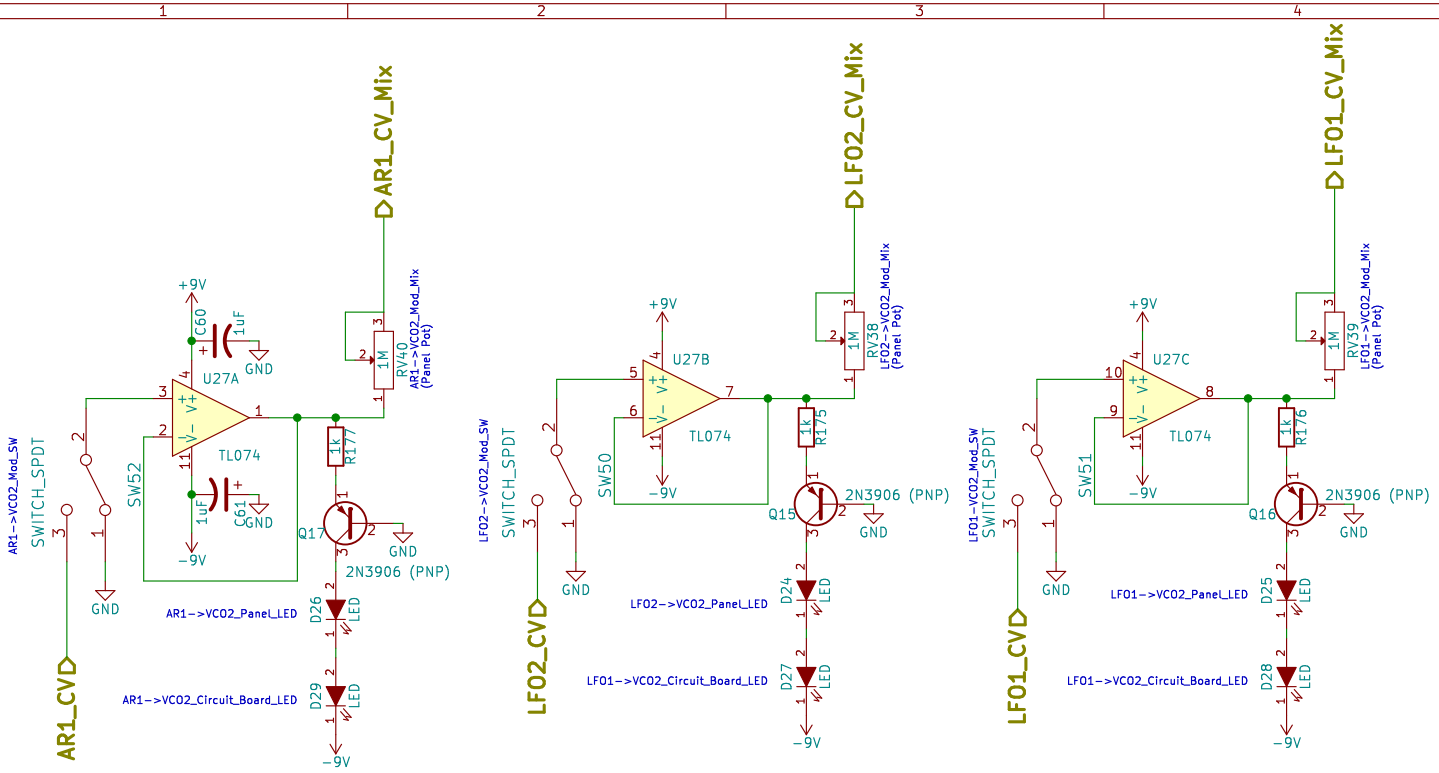
Sheet: /VCO1/VCO1 Exponential Converter/
File: VCO1 Exponential Converter.sch

Title: Exponential Converter (1V/Oct) — Dave Guenther

Size: USLetter	Date:	Rev:
KiCad E.D.A. kicad 4.0.2-stable		Id: 16/28


Triangle_In
Square_In
Sqr
Tri
Triangle
Square
U21A
U21B
U21C
U21D
U22A
U22B
U22C
U22D
TL074
U20A
TL072
+9V
-9V
GND
+6V
-6V
C46
C47
C48
C49
C44
C45
1uF
22k
R143
100k
R144
R145
R146
R147
R148
R149
R150
R151
R152
R153
R154
R155
R156
R157
100k1
100k2
100k3
RV32
RV33
RV34
RV35
RV36
RV37
250k
Offset
(Acquiesent about Gnd)
(Trim)
Scale to 5V PP
(Trim)
CV Offset (0 to 5V)
(Acquiesent about 2.5V)
(Trim)
Triangle (for Audio)
Square (for Audio)
Triangle (for CV)
Square (for CV)
SWITCH_DPDT
SW49
VCO1_Waveform_Select_SW
(Panel Switch)
Signal_Out(CV)
(0 to 5V)
Signal_out(Audio)
(-2.5 to 2.5V)
GUENTHER CHIPTUNE
Sheet: /VCO1/VCO1_Normalizer/
File: VCO1_Normalizer.sch
Title: VCO1 Audio and CV Normalizer
Dave Guenther 2016
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 4.0.2-stable
Id: 17/28


VCO2_Coarse_Tune (Panel)
VCO2_Fine_Tune (Panel)
POT5
POT6
POT7
POT8
R158
R159
R160
R161
R162
R163
R164
R165
R166
R167
R168
R169
R170
R171
R172
R173
R174
C50
C51
C52
C53
C54
C55
C56
C57
C58
C59
U23 TL071
U24 TL071
U25 TL071
U26
LM13700
1k Tempco
1N914
D23
2N3906 (PNP)
Q13
Q14
Matched Transistors (Delta Vbe < 2mV)
CV_In
Expo Converter portion of this schematic is based on:
"Musical Applications of Microprocessors", Hal Chamberlain
"Making Music with the 3080 OTA", Thomas Henry
GA-Tech recorded lectures by Aaron Lanterman
Sheet: VCO2 Output Normalizer
Pulse_In
Saw_In
Signal_Out(CV)
Signal_out(Audio)
VCO2 Output CV Normalizer
Signal_Out(CV)
Signal_Out(Audio)
File: VCO2 Output Normalizer.sch
Sheet: VCO2_CV_Ins
AR1_CVD
LFO1_CVD
LFO2_CVD
AR1_CV
LFO1_CV
LFO2_CV
AR1_CV_Mix
LFO2_CV_Mix
LFO2_CV
LFO1_CV_Mix
VCO2_CV_Ins
File: VCO2_CV_Ins.sch
GUENTHER CHIPTUNE
Sheet: /VCO2/
File: VCO2.sch
Title: VCO-2 Saw-Pulse Core (Based on LM13700)
Dave Guenther
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 4.0.2-stable
Id: 18/28

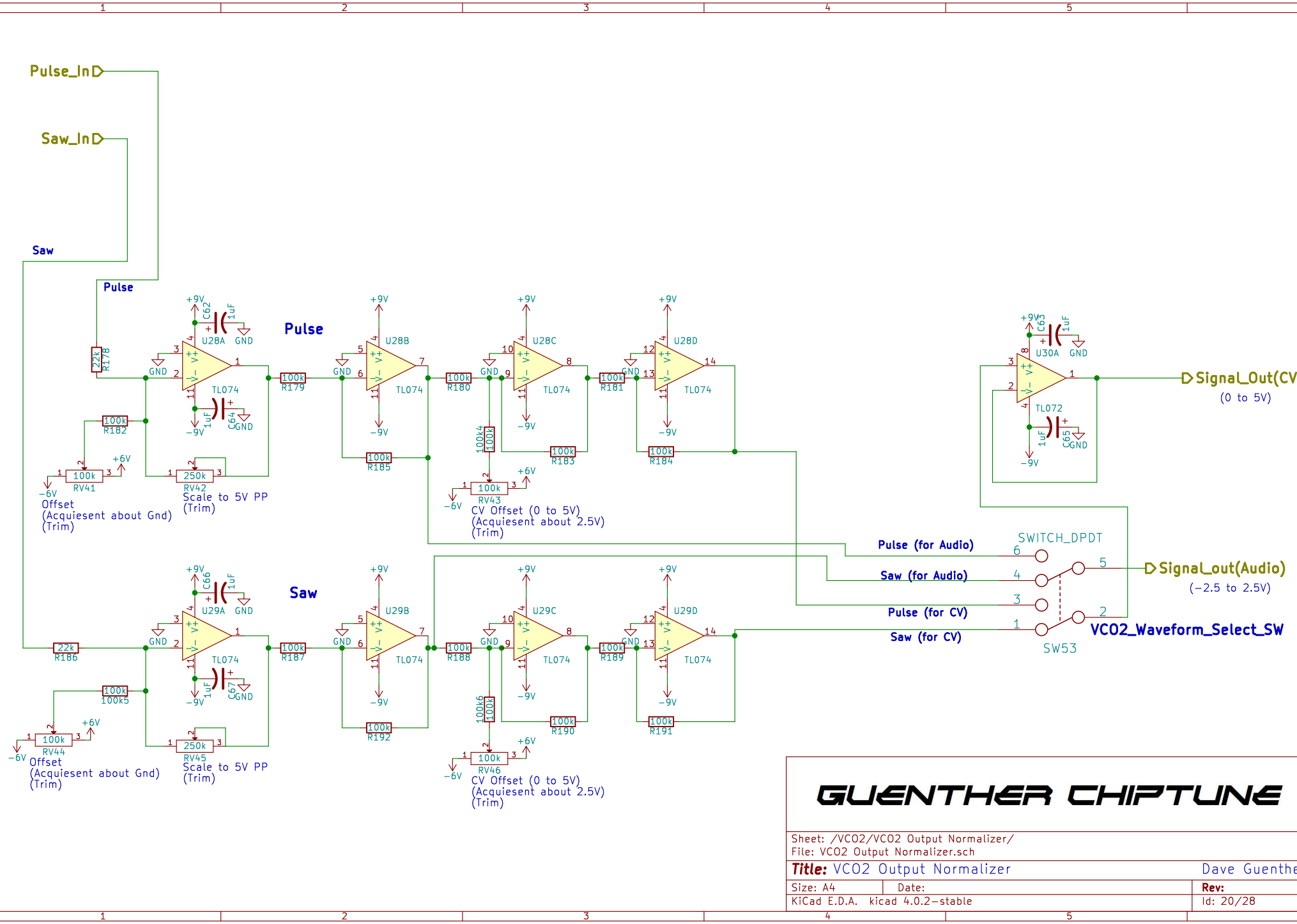


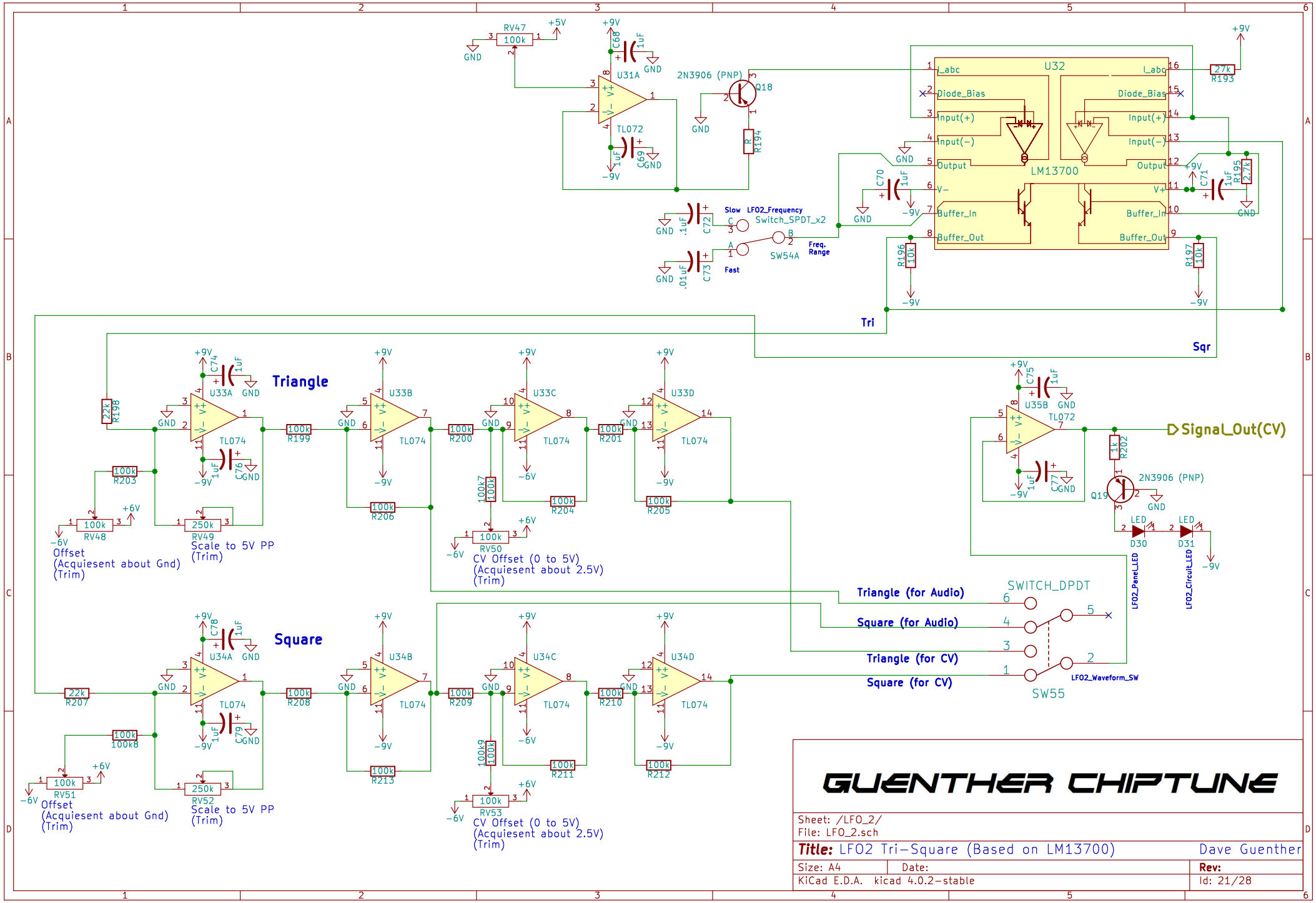
GUENTHER CHIPTUNE

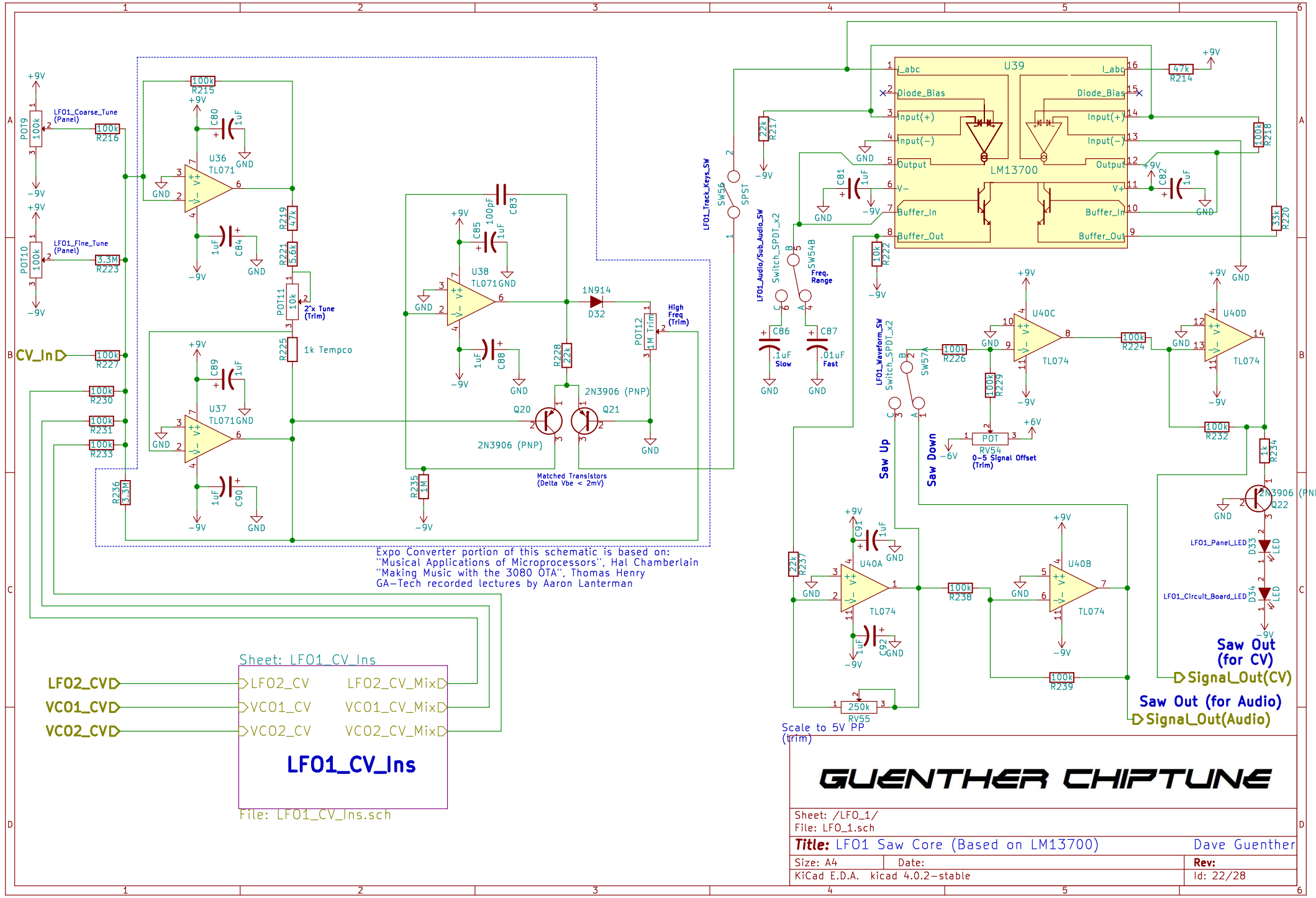
Sheet: /VCO2/VCO2_CV_Ins/
File: VCO2_CV_Ins.sch

Title: VCO2 CV Input Mixer — Dave Guenther

Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 4.0.2-stable		Id: 19/28


Pulse_In
Saw_In
Saw
Pulse
Pulse
Saw
U28A
U28B
U28C
U28D
U29A
U29B
U29C
U29D
U30A
TL074
TL072
GND
+9V
-9V
-6V
+6V
22k
R178
R186
100k
R179
R180
R181
R182
R183
R184
R185
R187
R188
R189
R190
R191
R192
100k5
100k4
100k6
RV41
RV42
RV43
RV44
RV45
RV46
250k
Offset
(Acquiesent about Gnd)
(Trim)
Scale to 5V PP
(Trim)
CV Offset (0 to 5V)
(Acquiesent about 2.5V)
(Trim)
C62
C63
C64
C65
C66
C67
1uF
Pulse (for Audio)
Saw (for Audio)
Pulse (for CV)
Saw (for CV)
SWITCH_DPDT
SW53
Signal_Out(CV)
(0 to 5V)
Signal_Out(Audio)
(-2.5 to 2.5V)
VCO2_Waveform_Select_SW
GUENTHER CHIPTUNE
Sheet: /VCO2/VCO2 Output Normalizer/
File: VCO2 Output Normalizer.sch
Title: VCO2 Output Normalizer
Dave Guenther
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 4.0.2-stable
Id: 20/28


RV47
100k
+5V
GND
U31A
TL072
C68
1uF
C69
1uF
2N3906 (PNP)
Q18
R194
U32
LM13700
I_abc
Diode_Bias
Input(+)
Input(−)
Output
V−
Buffer_In
Buffer_Out
V+
27k
R193
C70
1uF
C71
1uF
R195
2.7k
R196
10k
R197
10k
Slow
LFO2_Frequency
Switch_SPDT_x2
Freq. Range
SW54A
Fast
C72
.1uF
C73
.01uF
Tri
Sqr
Triangle
U33A
U33B
U33C
U33D
TL074
C74
1uF
C76
1uF
22k
R198
100k
R199
100k
R200
100k
R201
100k
R203
100k
R204
100k
R205
100k
R206
100k7
100k
RV48
RV49
250k
Offset
(Acquiesent about Gnd)
(Trim)
Scale to 5V PP
(Trim)
RV50
CV Offset (0 to 5V)
(Acquiesent about 2.5V)
(Trim)
Square
U34A
U34B
U34C
U34D
C78
1uF
C79
1uF
22k
R207
100k
R208
100k
R209
100k
R210
100k
100k8
100k
R211
100k
R212
100k
R213
100k9
100k
RV51
RV52
250k
Offset
(Acquiesent about Gnd)
(Trim)
Scale to 5V PP
(Trim)
RV53
CV Offset (0 to 5V)
(Acquiesent about 2.5V)
(Trim)
U35B
TL072
C75
1uF
C77
1uF
Signal_Out(CV)
1k
R202
2N3906 (PNP)
Q19
LED
D30
LED
D31
LFO2_PanelLED
LFO2_CircuitLED
Triangle (for Audio)
Square (for Audio)
Triangle (for CV)
Square (for CV)
SWITCH_DPDT
SW55
LFO2_Waveform_SW
GUENTHER CHIPTUNE
Sheet: /LFO_2/
File: LFO_2.sch
Title: LFO2 Tri-Square (Based on LM13700)
Dave Guenther
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 4.0.2-stable
Id: 21/28



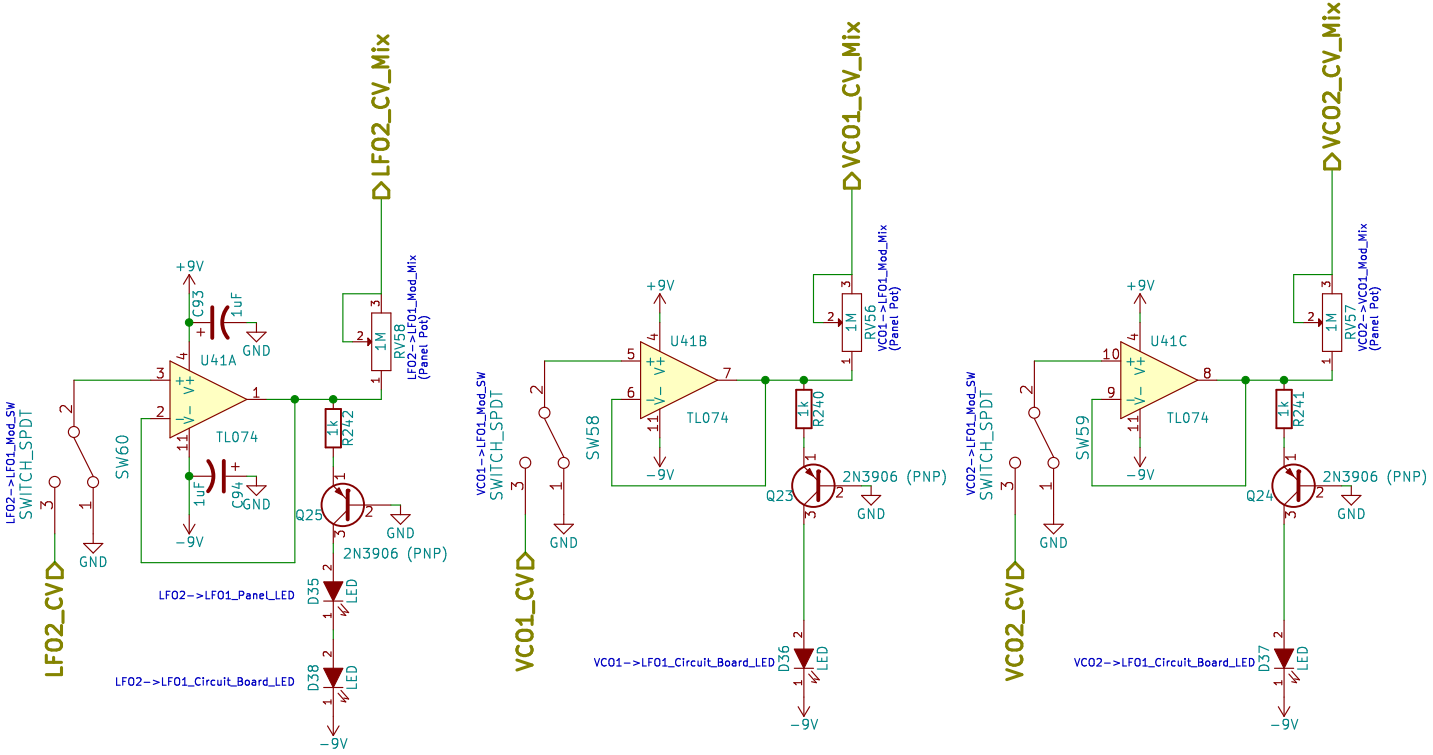
GUENTHER CHIPTUNE

Sheet: /LFO_1/
File: LFO_1.sch

Title: LFO1 Saw Core (Based on LM13700) — Dave Guenther

Size: A4 | Date: | **Rev:**

KiCad E.D.A. kicad 4.0.2-stable | Id: 22/28

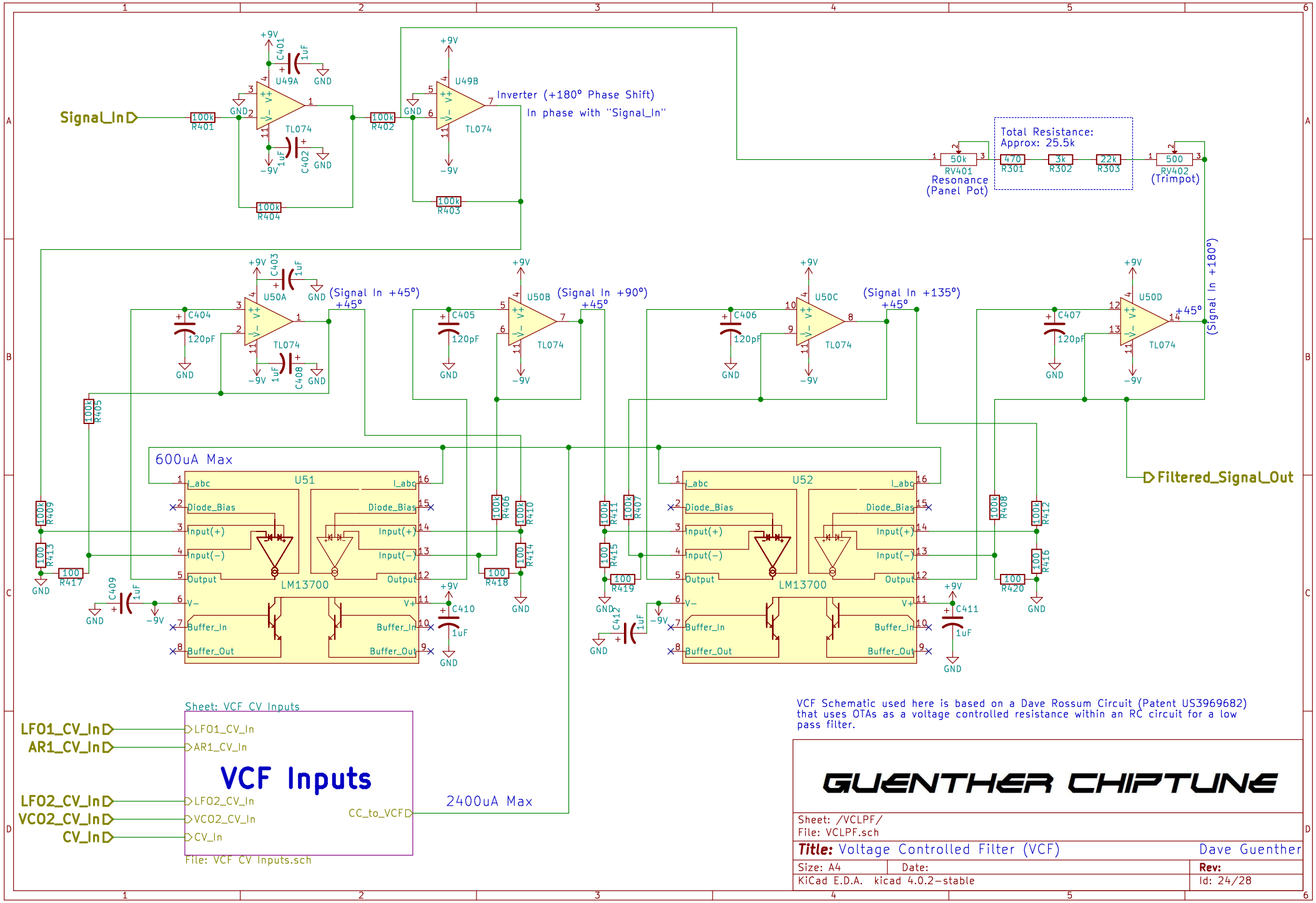


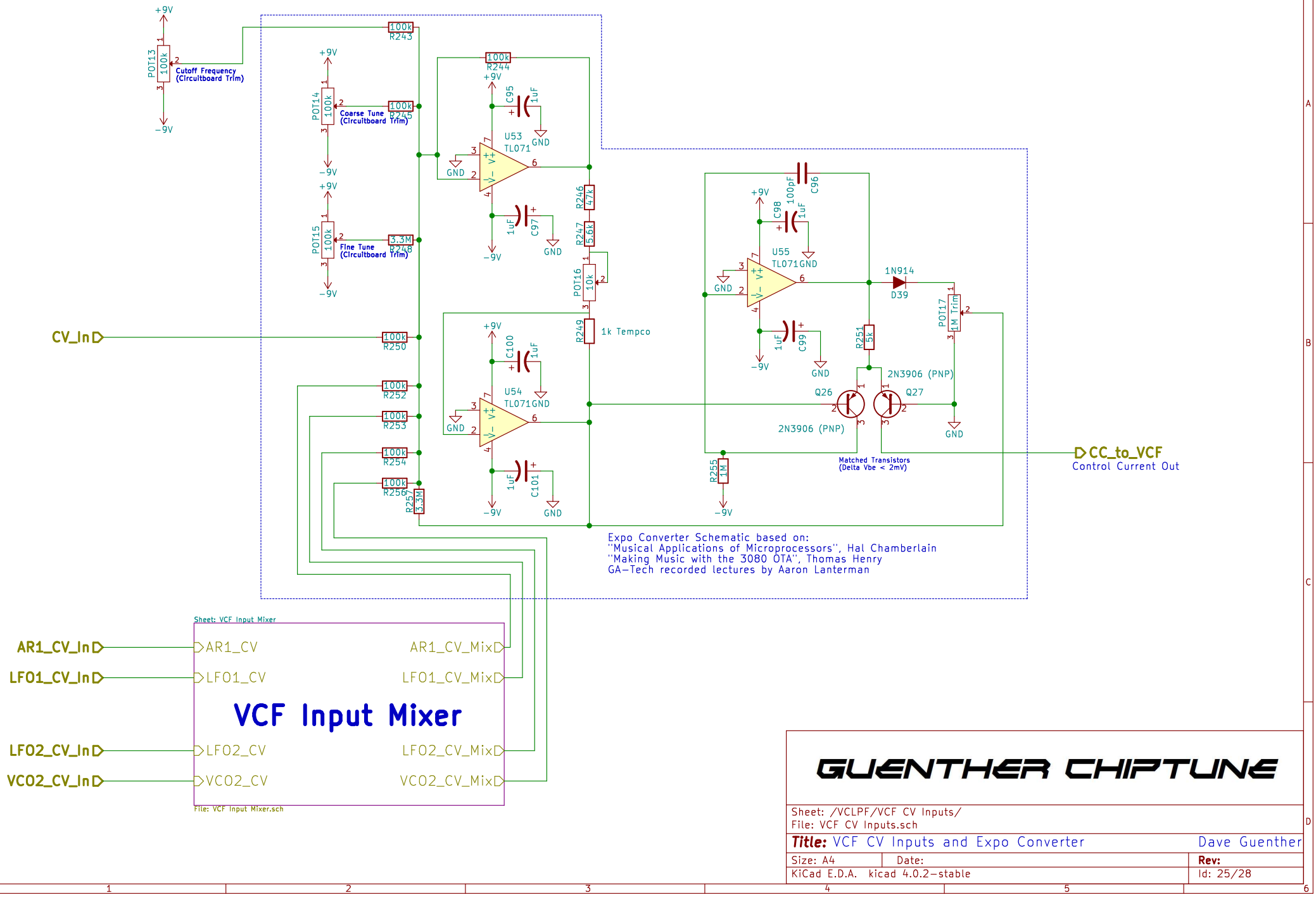
GUENTHER CHIPTUNE

Sheet: /LFO_1/LFO1_CV_Ins/
File: LFO1_CV_Ins.sch

Title: LFO1 CV Input Mixer — Dave Guenther

Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 4.0.2-stable		Id: 23/28


Signal_In
U49A
U49B
TL074
Inverter (+180° Phase Shift)
In phase with "Signal_In"
Total Resistance:
Approx: 25.5k
RV401
Resonance
(Panel Pot)
RV402
(Trimpot)
U50A
U50B
U50C
U50D
(Signal In +45°)
(Signal In +90°)
(Signal In +135°)
(Signal In +180°)
600uA Max
U51
U52
LM13700
Filtered_Signal_Out
Sheet: VCF CV Inputs
LFO1_CV_In
AR1_CV_In
LFO2_CV_In
VCO2_CV_In
CV_In
VCF Inputs
CC_to_VCF
2400uA Max
File: VCF CV Inputs.sch
VCF Schematic used here is based on a Dave Rossum Circuit (Patent US3969682) that uses OTAs as a voltage controlled resistance within an RC circuit for a low pass filter.
GUENTHER CHIPTUNE
Sheet: /VCLPF/
File: VCLPF.sch
Title: Voltage Controlled Filter (VCF)
Dave Guenther
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 4.0.2-stable
Id: 24/28

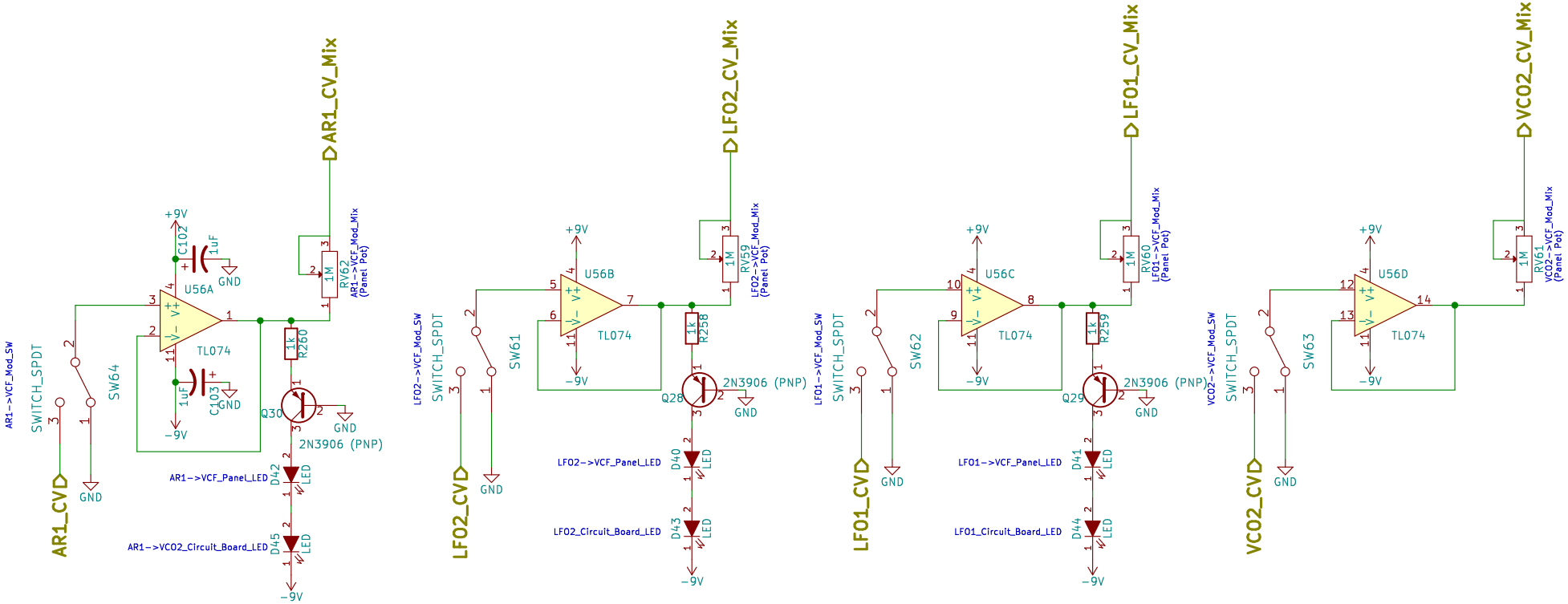


GUENTHER CHIPTUNE

Sheet: /VCLPF/VCF CV Inputs/
File: VCF CV Inputs.sch

Title: VCF CV Inputs and Expo Converter — Dave Guenther

Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 4.0.2−stable		Id: 25/28

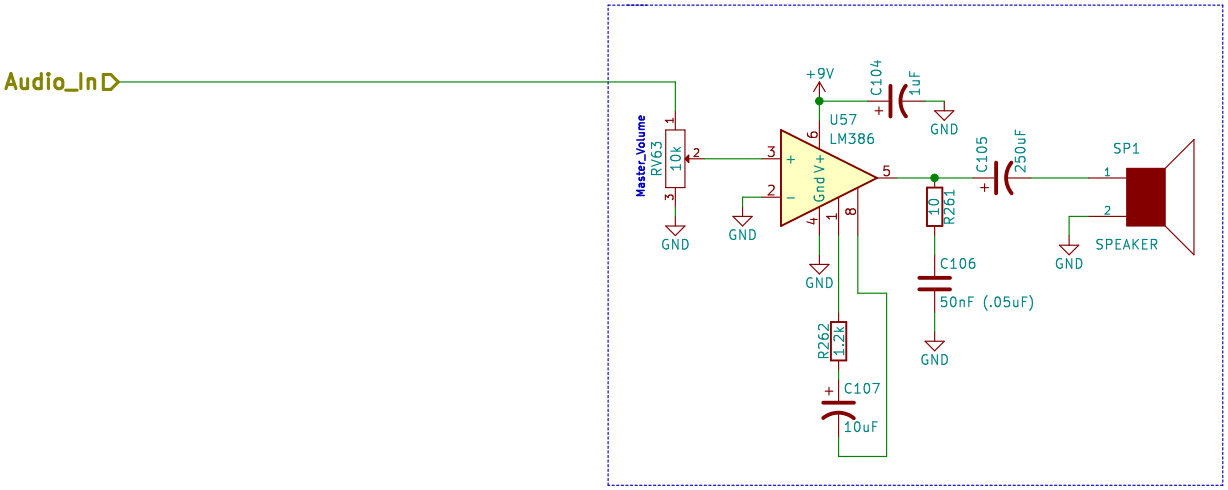


GUENTHER CHIPTUNE

Sheet: /VCLPF/VCF CV Inputs/VCF Input Mixer/
File: VCF Input Mixer.sch

Title: VCF Input Mixer — Dave Guenther

Size: A4	Date:	Rev:
KiCad E.D.A. kicad 4.0.2-stable		Id: 26/28



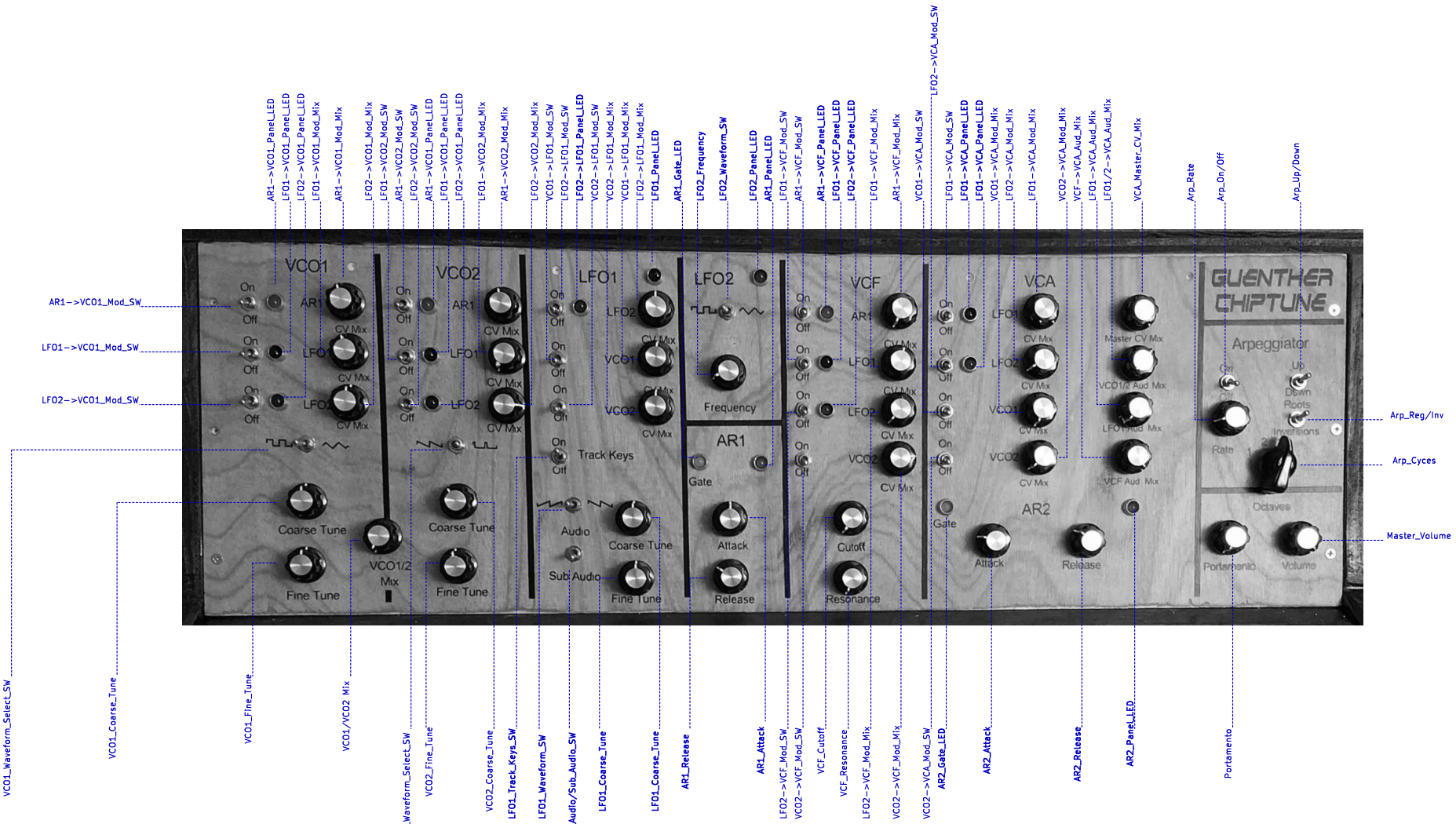
The Power Amplifier circuit was located on the Internet via Youtube.
Not my original work. Unfortunately I cannot locate the source.

GUENTHER CHIPTUNE

Sheet: /Audio_Amplifier/
File: file583D1674.sch

Title: Power Audio Amplifier — Dave Guenther

Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 4.0.2-stable		Id: 27/28



GUENTHER CHIPTUNE

Sheet: /Front Panel/
File: Front Panel.sch

Title: Chiptine Front Panel Design — **Dave Guenther**

Size: A4	Date:	Rev:
KiCad E.D.A. kicad 4.0.2-stable		Id: 28/28