DANDY HORSE

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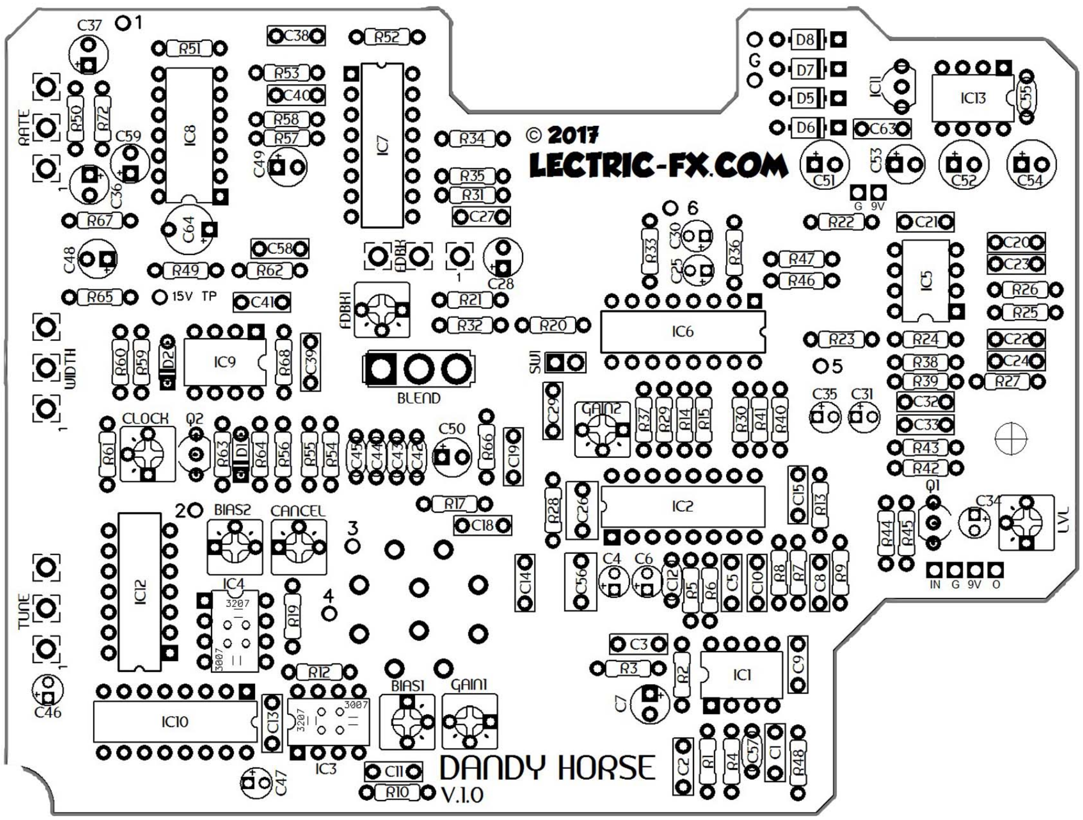
4-IN-1 EFFECT



The Dandy Horse is a clone of the vintage EHX Echo Flanger circuit, a 4-in-1 effect producing a chorus, flanger, fixed-flanger filter and double-track delay effect, adapted to use either two 3007 or two 3207* BBDs in place of the original's two unobtanium SAD1024.

Apart from the adaptation to more available BBD chips, several other mods to make this an easier-to-build circuit (and improvement over the original) have been incorporated, including:

- On-board charge pump to allow operation with a standard 9V power supply.
- LFO mod to eliminate the need for a 2M anti-log taper pot while providing the same speed range of the original.
- Output boost stage to remove the original's volume drop.

Additionally, several incorrect values from the available factory schematic have been altered to match those of production units. Unfortunately, while there are some things we can improve, one we could not is the original design itself, which has a propensity to emit a 'chirp' sound of feedback oscillation when the width and feedback controls are set up near full and the rate is relatively fast. This was compared against an original unit that exhibited the exact same behaviour. Additionally, while completely normal and expected, the circuit will also produce a fair amount of hiss at some more extreme settings, so please be aware that the circuit does have its quirks.

*3207 version has not been tested, please visit the madbeanpedals forum for updated information.

WARNING - This circuit is an incredibly difficult build and is in no way intended for beginners, so unless you have tackled a BBD delay circuit before, this is not the one to begin with! Proper set up will also require use of an audio probe and multimeter capable of reading frequencies up to at least 500kHz. This is not a circuit to attempt to bias by ear and expect to get right.

Bill of Materials:

Click **here** for BOM. This link takes you to a google sheet. You can sort by the parts value column to assist you in obtaining your “shopping list .”

Description of controls:

Mode: 4 position rotary control that switches between filter matrix (fixed flange), flange, chorus, and double-track delay.

Filter Matrix- basically disables the lfo sweep of the flange section, allowing manual flange sounds.
Flange- sweeping comb filter producing modulation effects
Chorus- sweeping modulation sounds
Double Track- short delay "slapback" echo

Knobs:

Rate- controls the speed of the modulation effect
Width- controls the depth of the modulation effect
Tune- in filter matrix mode, this control is used to manually tune to specific flange sounds.
in flange mode this control sets the center freq of the flange.
in chorus mode, this control sets how much slap back delay is introduced into the signal.
in double track mode, this control is used to control the amount of echo.
Note that at width full up the tune control wont have any effect, but will become increasingly active as the width level is decreased.
Feedback- this controls how much effected signal is fed back into the input.

Blend switch: toggles between 1: a blend of your instrument's audio signal & effected signal, & 2: only the effected wet signal.

As you can see, this is quite a complex effect, and the controls are interactive with each other in differing ways depending on mode selection.

Build Notes:

Lots of times when I build an effect, I "rock before I box" and only end up drilling an enclosure if it's something I want to keep. This one is a bit different by what I consider necessity. To get your pcb to sit straight within the enclosure, I recommend that you first drill your box. Install & screw down all of your pc mounted components in their correct placement holes (pots, mini 2p4t, blend switch if pc mounting) to the box, and then position the pcb onto all of the pins. This might take a minute. You may find it helpful to level out the pcb with extra washers on the pots, though it may not be necessary. Solder a pin from each pot and rotary to the pcb, keeping the pcb as level as possible while doing so, then go back and solder the rest when you're happy with the results. Then you take the pcb along with all those pc mounted parts from the enclosure to "rock". If you don't do it this way, your pcb will almost SURELY be tilted inside the enclosure. Besides not looking good, this can actually put undue stress on the pcb and can cause problems down the road. For instance, the first one of these I built had an issue where the sound would cut out intermittently and it was pretty frustrating to say the least. The second and third times I built it I used the technique described above and didn’t have that problem after that.

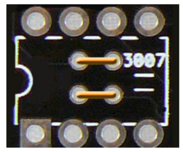
A 4mm standoff hole has been provided on the pcb to assist with leveling & stability. I used mouser part 534-9082 for this, but I found on my build it wasn't quite tall enough, probably due to the height of the rotary (YMMV). I put a small square of double stick foam under the standoff and that worked better for me. It could be that mouser part 534-9083 would be a better height but that is untested.

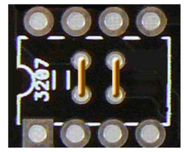
The SW1 pads on the pcb must be jumpered together for this effect to function when wired for true bypass!
For buffered bypass operation, the two wires from the SW1 pads need to be connected to a latching SPST switch (DPDT if you want a status LED).

Note: you should not install both C42 & 43 and C44 & C45 (only C42 & C44 should be installed as stock, 43 & 45 are for experimenting with clock frequency).
Also, omit c55 & c58.

Build Notes Cont'd:

Very Important as well: the pads should be jumpered underneath each MN3007/3207 for the particular version you are building. Please solder in these jumpers before you install sockets or chips for easier building.





For a build of this size I recommend laying out all your resistors before you start, and measure each one to double check it is what you think it is. This may seem like overkill, but it's easy to make mistakes when there are this many parts involved, and it can give you a bit more confidence you used the right values if you need to troubleshoot later.

Finally a word about the drill template. As you can see from my build on the next page, I chose to mount my blend switch off board. I think this makes it easier to level the pcb and allows you to place it wherever you want. You could even put it on top with the in/out jacks. I will provide a drill location for this switch in 2 different spots. **Please DO NOT drill both of them! Only drill the one you want to use for this switch!**

Set up and Biasing Procedure:

First things first, verify that the circuit is getting proper supply voltage, check at the 15v test pad for ~15V and then test at test pad 1 for ~7.5V.

Now set all trimmers to the midpoint and the controls as follow;
Tune - CW
Width - CCW
Rate - CCW
Feedback - CCW
Mode - Filter Matrix (CW) (Switch positions are the same as the original units)

Set your multimeter to the Hz setting and probe test pad #2 on the PCB and adjust the clock trimmer until you read 500kHz

Continue probing test pad #2 and turn the mode switch to the Slap Back (CCW) setting and without adjusting the clock trimmer the clock frequency should now hopefully read approximately 125kHz. If it reads too high you can use the extra clock cap pads provided (C45) to adjust this, experiment with small value caps (4.7-22pF will be a good place to start) until you reach the right ball park.
*Note - A second set of clock cap pads are also provided for the filter matrix mode (C43) should you struggle to achieve the right readings in both modes, larger value caps will lower the clock frequency and vice versa.

Now that you have the clock section set up properly, you can begin to bias the audio section of the circuit. For the next portion of the biasing procedure you will need your audio probe and to connect a constant input source to the pedal, be that constantly picking your guitar, a CD player or sine wave generator.

Set the controls as follow;
Tune - CW
Width - CCW
Rate - CCW
Feedback - CCW
Mode - Filter Matrix

Connect your audio probe to test pad 3 and begin turning the 'Bias2' trimmer, you should hopefully now hear (hissy, delayed) audio coming through, adjust it to where you feel is the clearest setting without distortion.

Switch to the Slap Back mode and connect your audio probe to test pad 4 and adjust 'Bias1' as above.

Now that you (hopefully) have audio at test pad 4, connect your audio probe back to test pad 3 while staying in slap back mode and turn the tune control CCW.
Begin adjusting the cancel trimmer. To the far left and right of the trimmers rotation you should hear a high pitched whining noise which should get gradually quieter in the middle portion of the trimmers rotation, adjust the trimmer to where you hear the least whine.

Setup and Biasing Procedure Cont'd:

Phew! Nearly done, just the gain and feedback trimmers left to go.

Set the controls as follows;
Tune - CW
Width - CCW
Rate - CCW
Feedback - CCW
Mode - Filter Matrix

This part can be quite tricky as you have to switch between test pads while adjusting the gain trimmers.

To start with begin adjusting the 'Gain2' trimmer, the aim is to reach equal signal level at test pads 5 & 6, just keep switching your audio probe between the two until it sounds right.
Now switch to Slap Back mode again and adjust the 'Gain1' trimmer until the level at test pad 6 is about 10% higher than test pad 5.

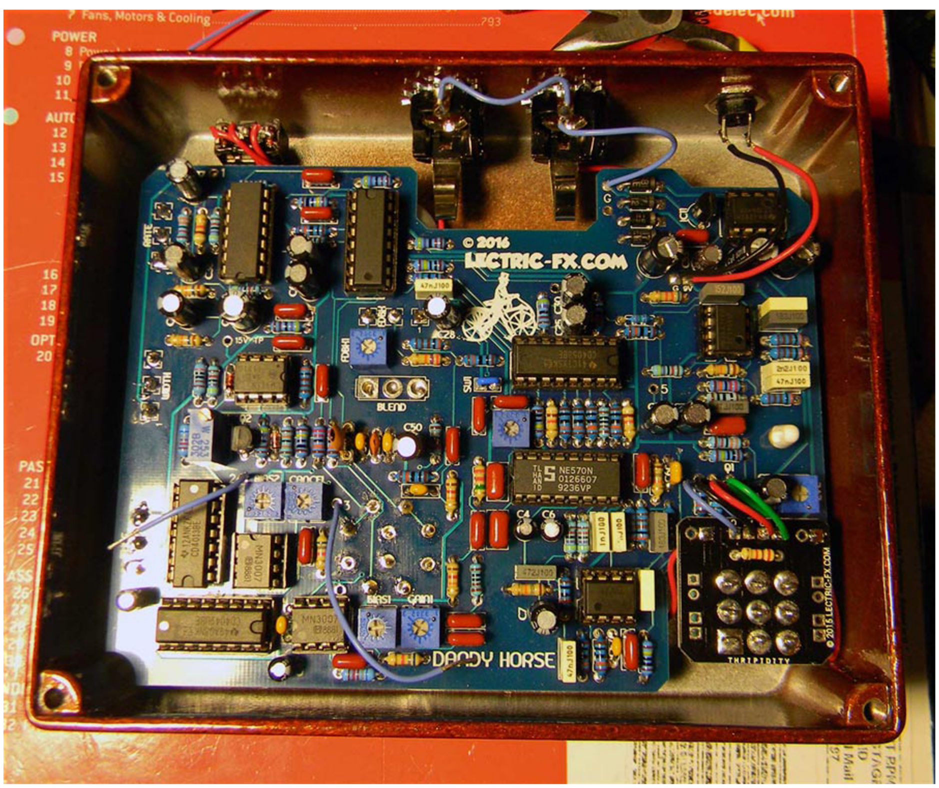
The final step is to set the feedback trimmer.

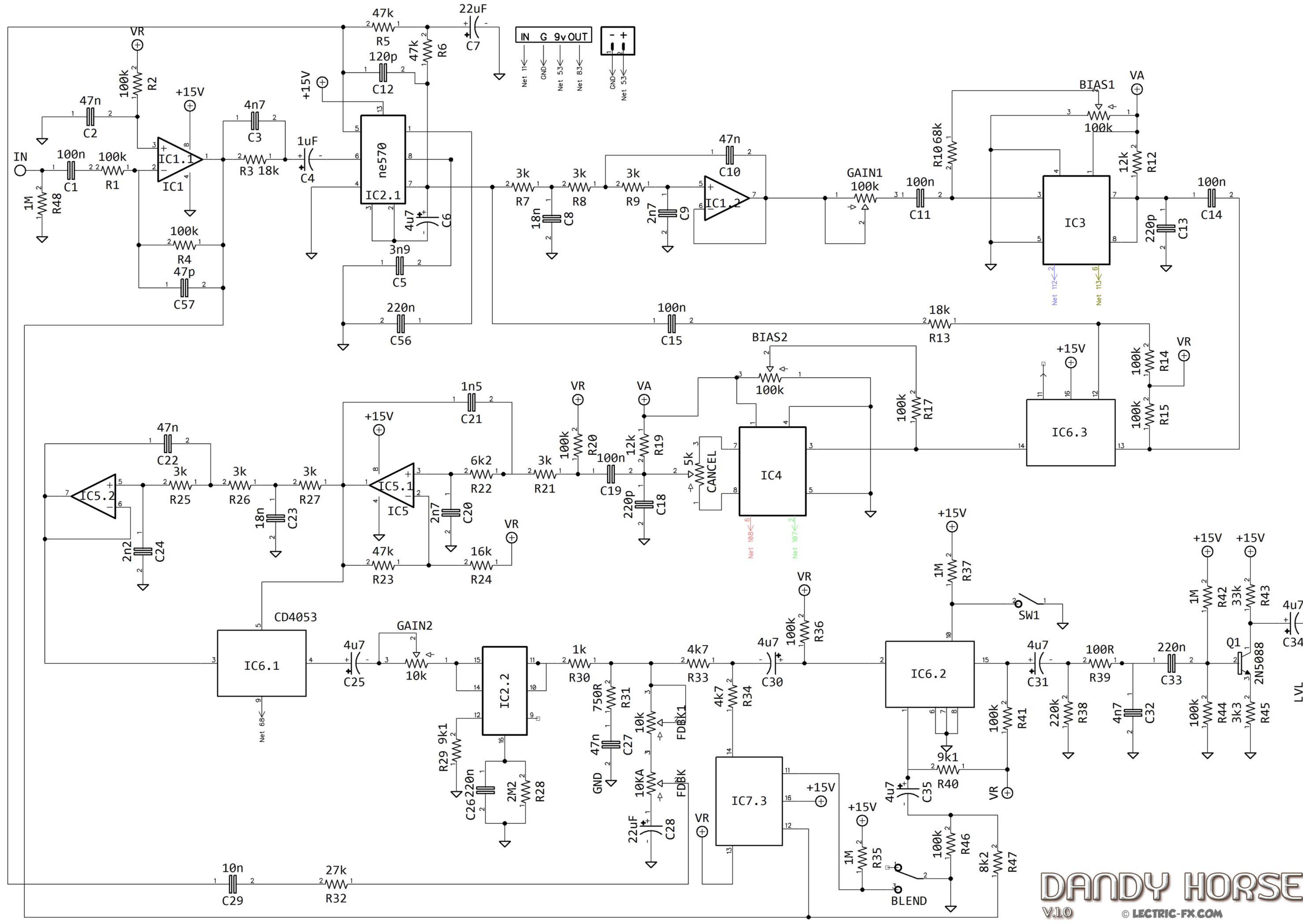
Set the controls as follows;
Tune - CCW
Width - CW
Rate - CCW
Feedback - CW
Mode - Flanger

And simpy adjust the 'FDBK1' Trimmer until just before the point of oscillation.

And lest I forget, adjust the level trimmer to match the level of the Dandy Horse to your bypass signal.

Congratulations! You have now set up your Dandy Horse circuit, you may need to go back through the procedure to tweak it to perfection but for now take a few moments to enjoy the fruits of your labour.




IN
OUT
VR
VA
+15V
GND
IC1.1
IC1.2
IC1
ne570
IC2.1
IC2.2
IC3
IC4
IC5
IC5.1
IC5.2
IC6.1
IC6.2
IC6.3
IC7.3
CD4053
Q1 2N5088
BIAS1
BIAS2
GAIN1
GAIN2
CANCEL
FDBK1
FDBK
LVL
SW1
BLEND
IN G 9v OUT
R1 100k
R2 100k
R3 18k
R4 100k
R5 47k
R6 47k
R7 3k
R8 3k
R9 3k
R10 68k
R12 12k
R13 18k
R14 100k
R15 100k
R17 100k
R19 12k
R20 100k
R21 3k
R22 6k2
R23 47k
R24 16k
R25 3k
R26 3k
R27 3k
R28 2M2
R29 9k1
R30 1k
R31 750R
R32 27k
R33 4k7
R34 4k7
R35 1M
R36 100k
R37 1M
R38 220k
R39 100R
R40 9k1
R41 100k
R42 1M
R43 33k
R44 100k
R45 3k3
R46 100k
R47 8k2
R48 1M
C1 100n
C2 47n
C3 4n7
C4 1uF
C5 3n9
C6 4u7
C7 22uF
C8 18n
C9 2n7
C10 47n
C11 100n
C12 120p
C13 220p
C14 100n
C15 100n
C18 220p
C19 100n
C20 2n7
C21 1n5
C22 47n
C23 18n
C24 2n2
C25 4u7
C26 220n
C27 47n
C28 22uF
C29 10n
C30 4u7
C31 4u7
C32 4n7
C33 220n
C34 4u7
C35 4u7
C56 220n
C57 47p
10k
10KA
100k
5k
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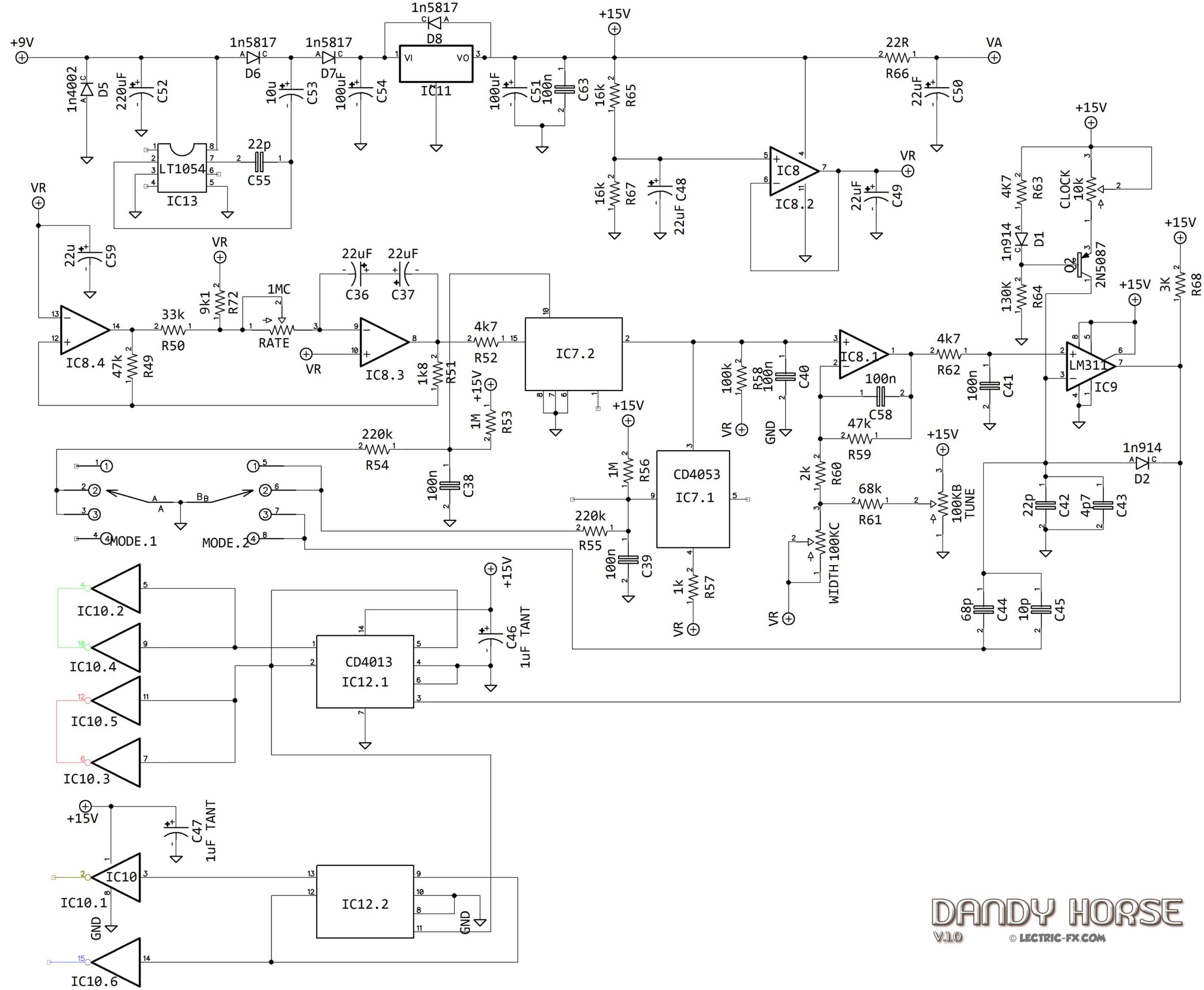
+9V
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D5
220uF
C52
1n5817
D6
10u
C53
1n5817
D7
100uF
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D8
IC11
100uF
C51
100n
C63
+15V
16k
R65
16k
R67
22uF C48
IC8
IC8.2
22uF
C49
VR
22R
R66
22uF
C50
VA
LT1054
IC13
22p
C55
VR
22u
C59
IC8.4
47k
R49
33k
R50
9k1
R72
1MC
RATE
22uF
C36
22uF
C37
IC8.3
1k8
R51
4k7
R52
IC7.2
+15V
1M
R53
220k
R54
100n
C38
MODE.1
MODE.2
+15V
1M
R56
220k
R55
100n
C39
CD4053
IC7.1
1k
R57
100k
R58
100n
C40
GND
IC8.1
100n
C58
47k
R59
2k
R60
68k
R61
WIDTH 100KC
100KB
TUNE
4k7
R62
100n
C41
4K7
R63
1n914
D1
130K
R64
CLOCK
10k
Q2
2N5087
LM311
IC9
3K
R68
1n914
D2
22p
C42
4p7
C43
68p
C44
10p
C45
IC10.2
IC10.4
IC10.5
IC10.3
CD4013
IC12.1
C46
1uF TANT
+15V
C47
1uF TANT
IC10
IC10.1
GND
IC12.2
GND
IC10.6
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Drill Template