Modulus Synthesiser DIY
Edition 8

Well, It's back another edition of modulus. The delay between them seems to be getting longer, for which I do apologise. This is due mainly to work load and time constraints. Next year (2000) I hope to start a degree course in electronics with the Open University, so time will be even more precious.

This months article comes from Jim Patchell .It goes into details about the principles behind the OTA which is commonly used in VCA's, VCF's and also VCO's. Its in two parts of which this is the first.

Also in this issue I have included a re-hash of the Penfold ADSR. I've re-jigged the schematic a little to make PCB layout easier, reduced the values of the variable resistors and added an opamp on the gate input so that you can adjust the trigger level. Also you will find a PCB foil at the back (modulus format of course) for two ADSR's on one Euro card, you will need to cut the PCB half way. The only off board wiring is for the gate socket, output socket and gate switch (which can be omitted).

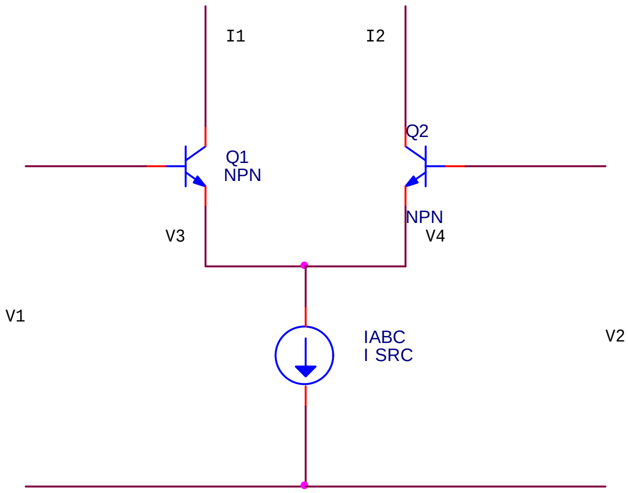
Another schematic is for an LFO with variable shape, this controls the slope of the waveform from saw to triangle and through to reverse saw. A word of warning, this does affect the speed slightly. I have built 4 of these into one modulus panel, if I get a chance I'll do a PCB for it too. You can use any value of Capacitor you want, two of mine use 0.47uF and two use 0.068uF (two values I had lying around that seemed to work at the speeds I wanted.

Without further ado, here is Jim's article followed by the schematics and foils for the ADSR and LFO.

The Value of Diode Linearzation

The use of linearization diodes in ota' s has many practical applications, although when they should apply is controversial. For instance, diode linearzation will give the OTA a much harder limit when the input reaches saturation, but on the other hand it can increase dynamic range. In some applications, such as filters, some may feel that the extra distortion you get without linearizing makes the filter much warmer. On the other hand, audio mixers can benefit from the lower distortion.

Lets look at a typical OTA. A very simplified OTA, in fact. I am getting rid of all of the current mirrors and such that you would find in a CA3080, CA3280, LM13700, etc. Basically, the output of an OTA is I1 – I2 as a function of V1-V2. So if we start to sum the voltages up (v3 and v4 are Vbe of the transistors), we find:



$V1 - V2 = V3 - V4$ (1)

$V3 = KT/q * \ln(I1/Ies1)$ (2)

$V4 = KT/q * \ln(I2/Ies2)$ (3)

$V1\text{-}V2 = KT/q(\ln(I1/Ies1) - \ln(I2/Ies2))$ (4)

Assume for matched transistors, Ies1 = Ies2

$Ies * \mathrm{Exp}(q/KT\ (v1\text{-}v2)) = I1 - I2 = Io$ (5)

If V2 = -V1 then equation (5) can be rewritten as

$Ies * \sinh(qV1/KT) = Io$ (6)

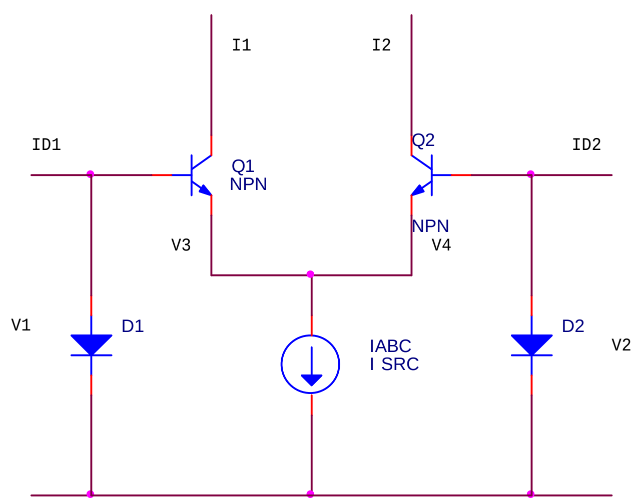
From equation (5) and (6) we can see a distinct dependence on the output current and temperature.

Now if we add linearizing diodes we get:

$V1 = KT/q * \ln(Id1/Ies)$ (7)

And

$V2 = KT/q * \ln(Id2/Ies)$ (8)



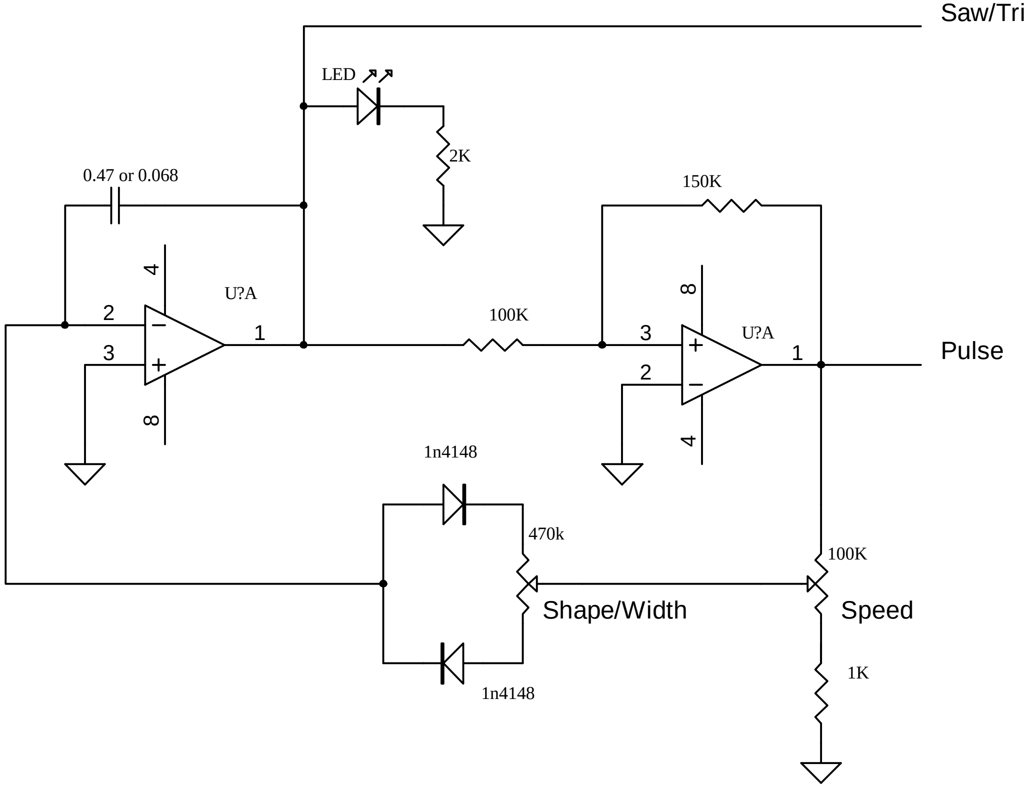
If we substitute (7) and (8) into back into (6) we notice that the q/KT cancels out. This is probably the most important aspect of linearizing diodes, the fact that they can cancel out the temperature drift that you get from an OTA.

Next time I hope to present some practical applications.

Thanks for that Jim, I look forward to the second part.

If anyone has any articles they would like to have put in the next edition of modulus it would be much appreciated. Please feel free to email me at ;-

Space_banana@hotmail.com



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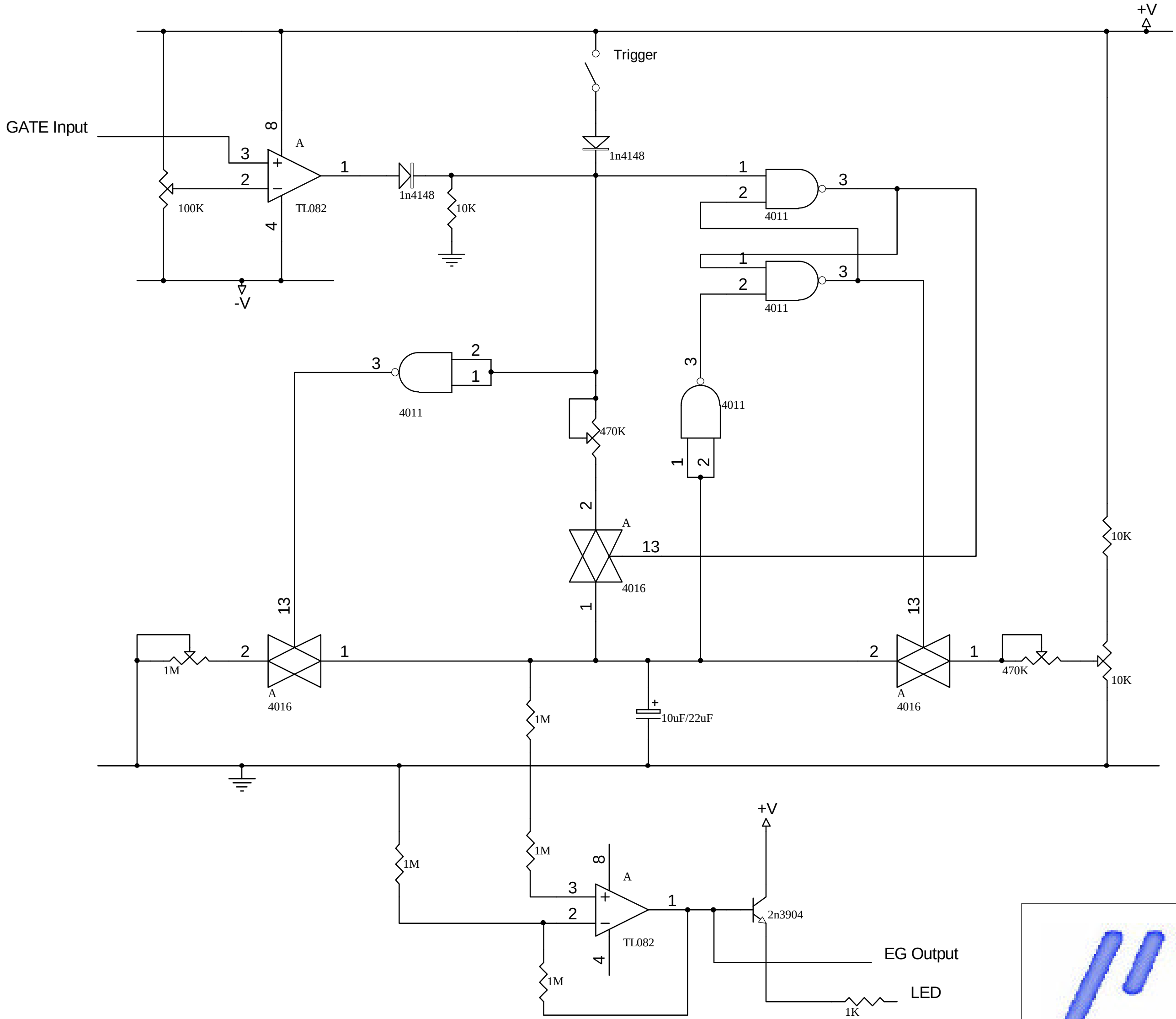
http://www.xavax.com/modulus

LFO

Size	FCSM No.	DWG No.	Rev
A		V1.0	a

Scale

Sheet 1 of 1



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ADSR

Size	FCSM No.	DWG No.	Rev
B		1	1.02

Scale

Sheet 1 of 1

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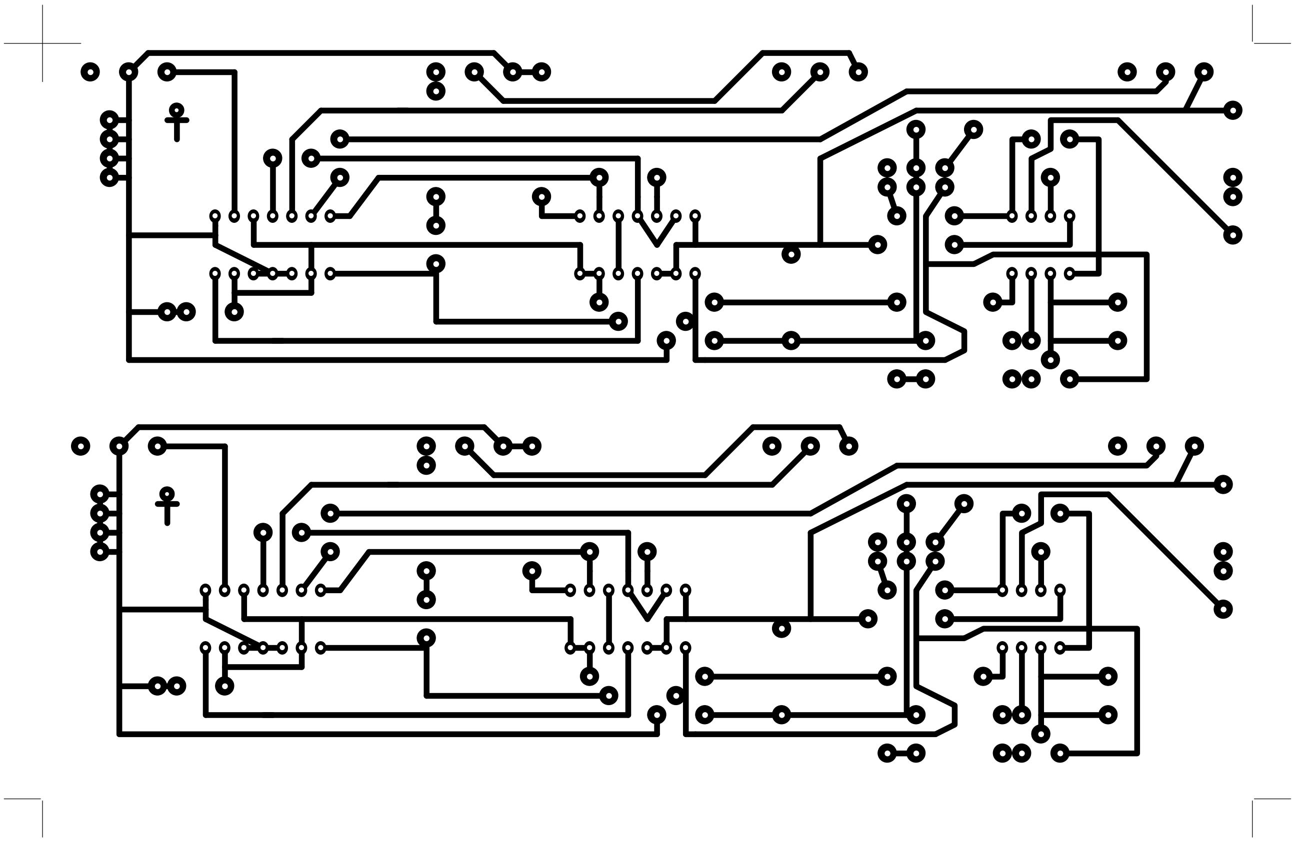
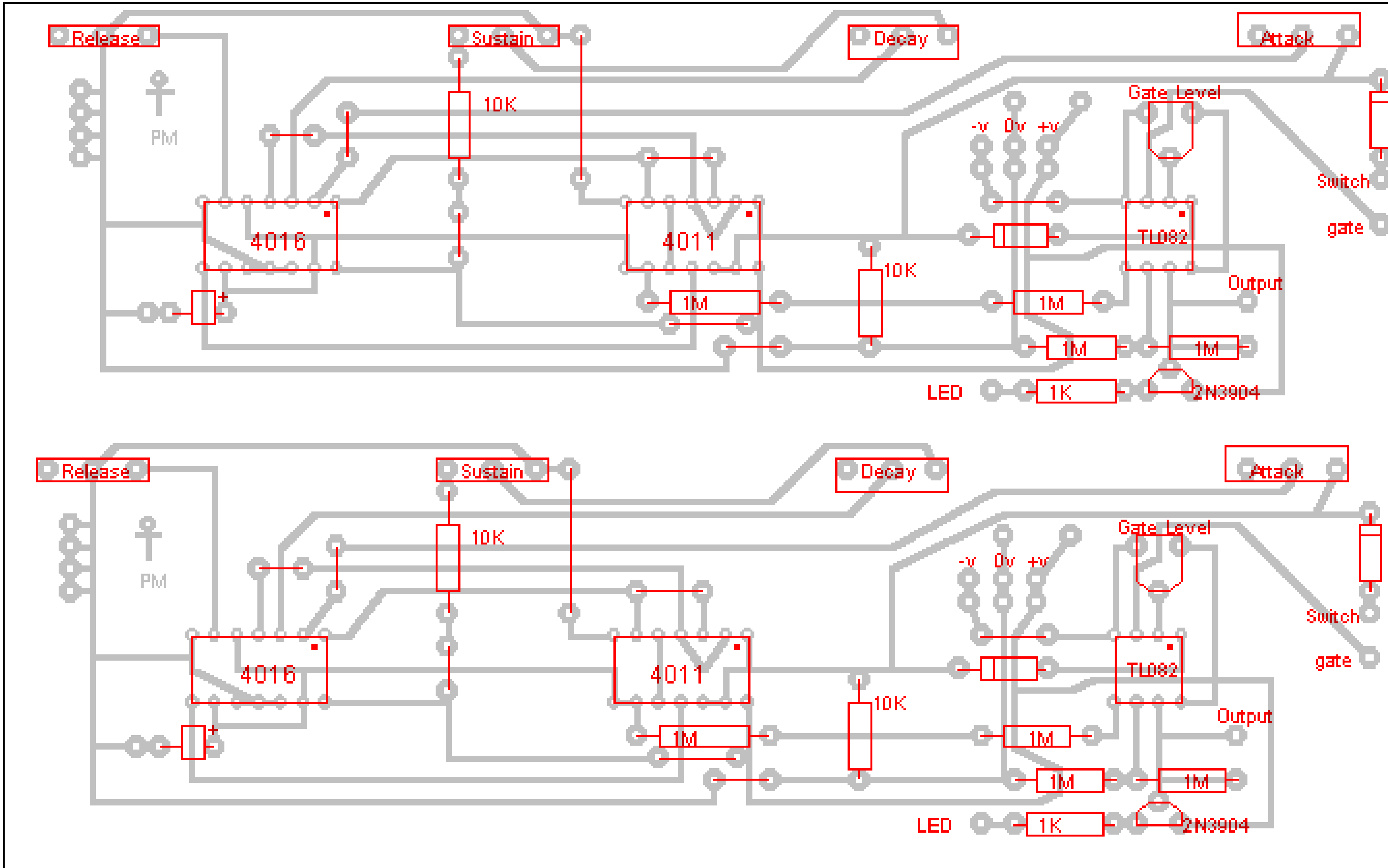
Windows PCB Designer by Niche Software
Created 12:37 10 Sep 1996 (Last Saved at 23:09 13 Sep 1999)





Release
Sustain
Decay
Attack
PM
10K
Gate Level
-v
0v
+v
Switch
4016
4011
TL082
gate
10K
Output
+
1M
1M
1M
1M
LED
1K
2N3904
Release
Sustain
Decay
Attack
PM
10K
Gate Level
-v
0v
+v
Switch
4016
4011
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