

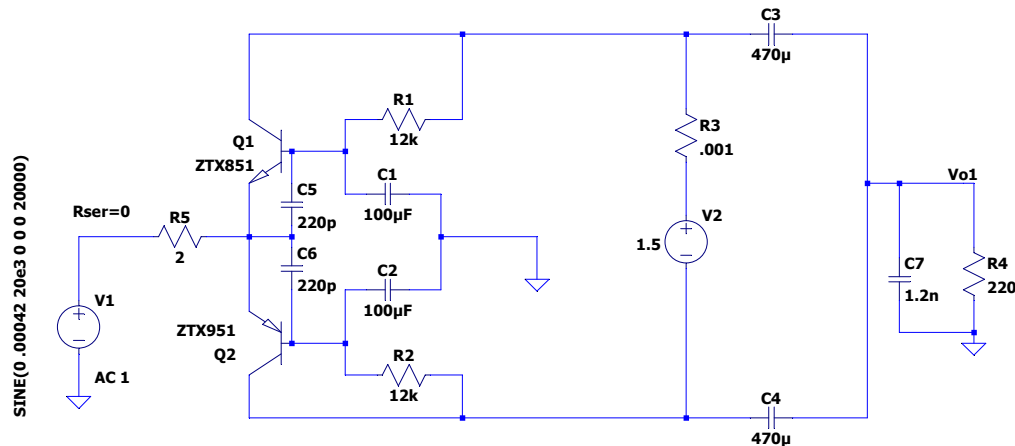
'Hawking' modified for flat gain and lowest distortion

373/482 pico Volts/rt Hz ; Current supply ~3 mA;

Gain varies with generator source resistance (23dB at 10R, 27dB at 5R, 30dB at 2R)

Distortion 0.002% (10R - 300μV cart)

Zin = 4.4 R



```
.MODEL ZTX951 PNP (IS=1.3766E-12 NF=1.013 BF=187 IKF=5.0 VAF=66.3
+ISE=1.4E-13 NE=1.41 NR=1.0099 BR=56 IKR=0.9 VAR=33 ISC=1.7E-12
+NC=1.4 RB=1.2 RE=0.020 RC=0.0255 CJC=287E-12 MJC=0.4522
+VJC=0.4956 CJE=1.15E-9 TF=0.83E-9 TR=20E-9)
```

```
.MODEL ZTX851 NPN (IS =1.0085E-12 NF =1.0001 BF =240 IKF=5.1 VAF=158
+ISE=2E-13 NE =1.38 NR =0.9988 BR =110 IKR=5.5 VAR=46 ISC=4.6515E-13
+NC =1.334 RB =1.5 RE =0.018 RC =0.015 CJC=155E-12 MJC=0.4348-12
+MJC=0.4348 VJC=0.6477 CJE=1.05E-9 TF =0.79E-9 TR =24E-9)
```

```
.four 20k V(Vo1)
.param plotwinsize = 0
.param numdgt = 15
.noise V(Vo1) V1 dec 100 1 20e3
;ac dec 100 1 2e4
.step param Rser 5 10 5
```

```
;tran 0 1ms 0 100n
```