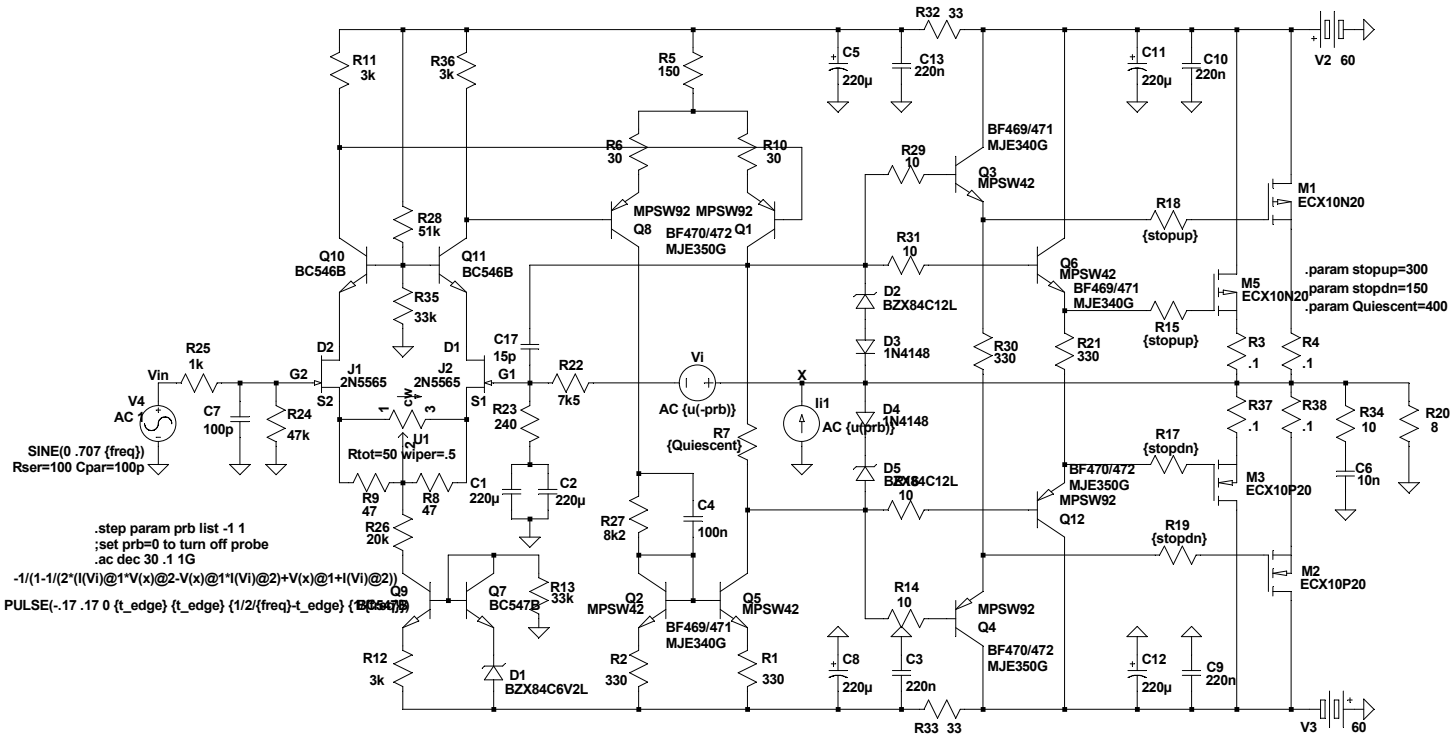


```
.SUBCKT ECX10N20 1 2 3
M1 9 7 8 8 MM L=1 W=1
* Default values used in MM:
* The capacitances are added externally
* Other default values are:
*   RS=0 RD=0 LD=0 CBD=0 CBS=0 CGBO=0
.MODEL MM NMOS LEVEL=1 IS=1e-32
+VTO=0.473 LAMBDA=0.092 KP=1.585
RS 8 3 0.41
D1 8 9 MD
.MODEL MD D IS=1.0e-32 N=50 BV=250
+CJO=1.0e-9 VJ=0.7 M=0.5
RDS 8 9 1e+06
RD 9 1 0.58
RG 2 7 80
* Gate Source capacitance Cgs0
CAP1 7 8 400e-12
**********
* Gate Drain capacitance Cdg0
CAP 7 4 10.5e-12
**********
* Gate Drain Capacitance Cdgj0
* Modelled as a diode
D2 4 9 MDD
.MODEL MDD D IS=1e-32 N=50
+CJO=94.8e-12 VJ=0.3 M=1
**********
.ENDS ECX10N20

.SUBCKT ECX10P20 1 2 3
M1 9 7 8 8 MM L=1 W=1
* Default values used in MM:
* The capacitances are added externally
* Other default values are:
*   RS=0 RD=0 LD=0 CBD=0 CBS=0 CGBO=0
.MODEL MM PMOS LEVEL=1 IS=1e-32
+VTO=-0.426 LAMBDA=0.073 KP=0.673
RS 8 3 0.342
D1 9 8 MD
.MODEL MD D IS=1.0e-32 N=50 BV=250
+CJO=1.45e-9 VJ=0.446 M=0.377
RDS 8 9 1e+06
RD 9 1 0.523
RG 2 7 45.2
* Gate Source capacitance Cgs0
CAP1 7 8 696e-12
**********
* Gate Drain capacitance Cdg0
CAP 7 4 15.2e-12
**********
* Gate Drain Capacitance Cdgj0
* Modelled as a diode
D2 9 4 MDD
.MODEL MDD D IS=1e-32 N=50
+CJO=27.6e-12 VJ=0.817 M=0.871
**********
.ENDS ECX10P20
```

```
;op
.options plotwinsize=0
.options method=gear
.options numdgt=15
.param Freq=20k
.param numcyc=100
.param dlycyc=5
.param FFT=2**16
.param simtime=numcyc/Freq+dlytime
.param dlytime=dlycyc/Freq
.param timestep=(simtime-dlytime)/FFT
.four {Freq} V(Vin) V(Vout)
.four {Freq} 4 V(Vin) V(Vout)
;
;tran 0 {simtime} {dlytime} {timestep}

.option numdgt=15

.option reltol=1e-6
.option ptrantau=0
;
.ac dec 1k 1 1G


.inc potentiometer.sub
```