

032

#### Models

```
*ECW20N20 VDMOS with subthreshold
.model ECW20N20 VDMOS (Rg=30 Vto=(0.155-1.6m*(Tjp-25))
+ Rs=(0.12*(1+2.5m*(Tjp-25))) Kp=(2.40*(1+7.4m*(Tjp-25))
+ Ksubthres=(0.09*(1+1m*(Tjp-25))) Mtriode=0.3 Rsd=0.16 Lambda=3m
+ Cgdmax=200p Cgdmin=10p a=0.25 Cgs=1200p Cjo=2200p
+ m=0.7 VJ=2.5 IS=8.0E-6 N=2.4 mfg=IH51206)
```

```
*ECW20P20 VDMOS with subthreshold
.model ECW20P20 VDMOS (pchan Rg=30 Vto=(-0.61+2.2m*(Tjp-25))
+ Rs=(0.17*(1+2.0m*(Tjp-25))) Kp=(1.85*(1+8.4m*(Tjp-25))
+ Ksubthres=(0.105*(1+5m*(Tjp-25))) Mtriode=0.35 Rsd=0.05 Lambda=5m
+ Cgdmax=430p Cgdmin=50p a=0.25 Cgs=1800p Cjo=2400p
+ m=0.7 VJ=2.5 IS=8.0E-6 N=2.4 mfg=IH51206)
```

```
.model LED_GREEN D(Is=8.2e-25 N=1.46 Rs=5.1 Eg=2.23 Tnom=27deg)
```

```
.MODEL KSA992 pnp (
+ IS=4.0544E-13 BF=365.1 NF=1
+ BR=0.20 NR=1.0 ISE=4.0544E-14
+ NE=1.5 ISC=1.0378E-13 NC=1.5
+ VAF=13 VAR=100 IKF=36.498
+ IKR=0.0225 RB=186 RBM=1.04
+ IRB=1.0125E-6 RE=0.0044 RC=0.048
+ CJE=2.3093E-11 VJE=0.855 MJE=0.4404
+ FC=0.5 CJC=6.8251E-12 VJC=0.64
+ MJC=0.2897 XTB=1.2849 EG=1.1603
+ XTI=3 TF=5.86e-10 XTF=4.0
+ ITF=0.024 VTF=4.0 TR=1.0e-8)
```

#### .MODEL KSA1381 pnp

```
+ IS = 5.5544E-14
+ BF = 148
+ BR = 1.592
+ ISE = 2.0546E-15
+ NE = 1.5
+ ISC = 3.24807E-10
+ NC = 2
+ VAF = 580
+ VAR = 100
+ IKF = 0.2163
+ IKR = 0.057544
+ RB = 10.18
+ RE = 0.0512
+ CJE = 9.572E-12
+ VJE = 0.748
+ MJE = 0.371
+ FC = 0.5
+ CJC = 1.147E-12
+ VJC = 0.541
+ MJC = 0.329
+ VTF = 1.0312E-09
+ XTB = 0.907
+ EG = 0.62
+ XTI = 3
```

#### .MODEL KSC3503 npn

```
+ IS=3.510E-14 BF=174.09 VAF=600
+ IKF=0.12325 ISE=2.2538E-13 NE=2.0
+ BR=0.64499 VAR=100 IKR=0.43102
+ ISC=6.4644E-10 NC=1.5 RBM=0.048
+ RC=0.815 RB=8.134 CJE=8.10E-12 MJC=0.401
+ IRB=3.0e-6 CJC=8.20E-12 MJC=0.31
+ VJE=0.75 CJC=9.995E-10 XTF=2
+ VTF=35 ITF=1 TR=1.0E-8
+ EG=0.84 XTB=2.5 FC=0.5
```

#### .MODEL KSC1845 npn

```
+ IS=5.075431E-13 BF=620.7 NF=1
+ BR=0.365 NR=1 ISE=1.68107E-12
+ NE=2.0 ISC=1.8378E-12 NC=1.5
+ VAF=82.803 VAR=100 IKF=0.20596
+ IKR=0.0190546 RB=107 RBM=0.292
+ IRB=1.268925E-6 RE=0.15 RC=0.29
+ CJE=1.10447E-11 VJE=0.7300286 MJE=0.1619943
+ FC=0.5 CJC=5.625739E-12 VJC=0.45
+ MJC=0.3059045 XTB=1.7281 EG=1.1809
+ XTI=3 TF=1.108e-9 XTF=2.250
+ ITF=0.0044 VTF=4.0 TR=1.0e-8)
```

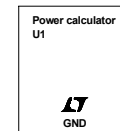
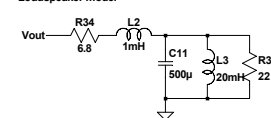
#### Input signals

```
***20kHz sine wave 100W/8R - SINE (0 2 20k)***
***Assym. step response - PULSE(0 1 0 100n 100n 50u 100u)***
***Symm. step response - PULSE(-1 1 0 100n 100n 50u 100u)***
***Total gain = 20x > 26dB***
```

#### Parameters

```
.param Tjp=50C - Temperature of MOSFETs
.four 20k V(Vout)
.options plotwinsize=0.options numdgt=12
;ac oct 10 10 1G
.tran 0 3000u 2500u 10n steady ulc
;op 0 4000u 3500u 10n steady ulc
```

#### Loudspeaker model



.include powcalc.sub

Open loop gain:  
V(out)/V(a,b)  
A=non inverting input  
B=inverting input