



```
.option plotwsize=0
.param freq=1k
.param fft=2*pi**11
.four {freq} V(out_plus)
.tran 0 {10/freq} 0 {10/freq/fft}
```

```
.MODEL Qmj15003 npn
+IS=1e-09 BF=226.431 NF=0.85 VAF=43.4348
+IKF=10 ISE=1e-08 NE=1.79698 BR=1.65466
+NR=1.5 VAR=434.348 IKR=4.42319 ISC=5.49997e-09
+NC=3.18751 RB=43.922 IRB=0.1 RBM=0.1
+RE=0.0001 RC=0.20765 XTB=0.746102 XTI=1
+EG=1.05 CJE=9.62276e-08 VJE=0.505131 MJE=0.650363
+TF=9.99972e-09 XTF=1.35733 VTF=0.996711 ITF=0.999802
+CJC=1.22855e-09 VJC=0.95 MJC=0.23 XCJC=0.803115
+FC=0.638728 CJS=0 VJS=0.75 MJS=0.5
+TR=1e-07 PTF=0 KF=0 AF=1
```

```
.MODEL Qmj15004 pnp
+IS=1e-09 BF=226.431 NF=0.85 VAF=43.4348
+IKF=10 ISE=1e-08 NE=1.79698 BR=1.65466
+NR=1.5 VAR=434.348 IKR=4.42319 ISC=5.49997e-09
+NC=3.18751 RB=43.922 IRB=0.1 RBM=0.1
+RE=0.0001 RC=0.20765 XTB=0.746102 XTI=1
+EG=1.05 CJE=9.99946e-08 VJE=0.4 MJE=0.658304
+TF=9.99972e-09 XTF=1.3573 VTF=0.996475 ITF=0.99985
+CJC=1.22854e-09 VJC=0.95 MJC=0.23 XCJC=0.803124
+FC=0.761291 CJS=0 VJS=0.75 MJS=0.5
+TR=1e-07 PTF=0 KF=0 AF=1
```

```
.model BC560C PNP(Is=1.02f Xti=3 Eg=1.11 Vaf=34.62 Bf=401.6 Ise=38.26p
+ Ne=5.635 Ikf=74.73m Nk=.512 Xtb=1.5 Br=9.011 Isc=1.517f
+ Nc=1.831 Ikr=.1469 Rc=1.151 Cjc=9.81p Mjc=.332 Vjc=.4865 Fc=.5
+ Cje=30p Mje=.3333 Vje=.5 Tr=10n Tf=524p Itf=.9847 Xtf=17.71
+ Vtf=10)
```

```
.MODEL Qbd139 npn
+IS=1e-09 BF=222.664 NF=0.85 VAF=36.4079
+IKF=0.166126 ISE=5.03418e-09 NE=1.45313 BR=1.35467
+NR=1.33751 VAR=142.931 IKR=1.66126 ISC=5.02557e-09
+NC=3.10227 RB=26.9143 IRB=0.1 RBM=0.1
+RE=0.000472454 RC=1.04109 XTB=0.727762 XTI=1.04311
+EG=1.05 CJE=1e-11 VJE=0.75 MJE=0.33
+TF=1e-09 XTF=1 VTF=10 ITF=0.01
+CJC=1e-11 VJC=0.75 MJC=0.33 XCJC=0.9
+FC=0.5 CJS=0 VJS=0.75 MJS=0.5
+TR=1e-07 PTF=0 KF=0 AF=1
```

```
.MODEL D1N4148 D(Is=0.1P RS=16 CJO=2P TT=12N BV=100 IBV=3.867E-10)
```

```
.MODEL Qbd140 pnp
+IS=1e-09 BF=650.842 NF=0.85 VAF=10
+IKF=0.0950125 ISE=1e-08 NE=1.54571 BR=56.177
+NR=1.5 VAR=2.11267 IKR=0.950125 ISC=1e-08
+NC=3.58527 RB=41.7566 IRB=0.1 RBM=0.108893
+RE=0.000347052 RC=1.32566 XTB=19.5239 XTI=1
+EG=1.05 CJE=1e-11 VJE=0.75 MJE=0.33
+TF=1e-09 XTF=1 VTF=10 ITF=0.01
+CJC=1e-11 VJC=0.75 MJC=0.33 XCJC=0.9
+FC=0.5 CJS=0 VJS=0.75 MJS=0.5
+TR=1e-07 PTF=0 KF=0 AF=1
```