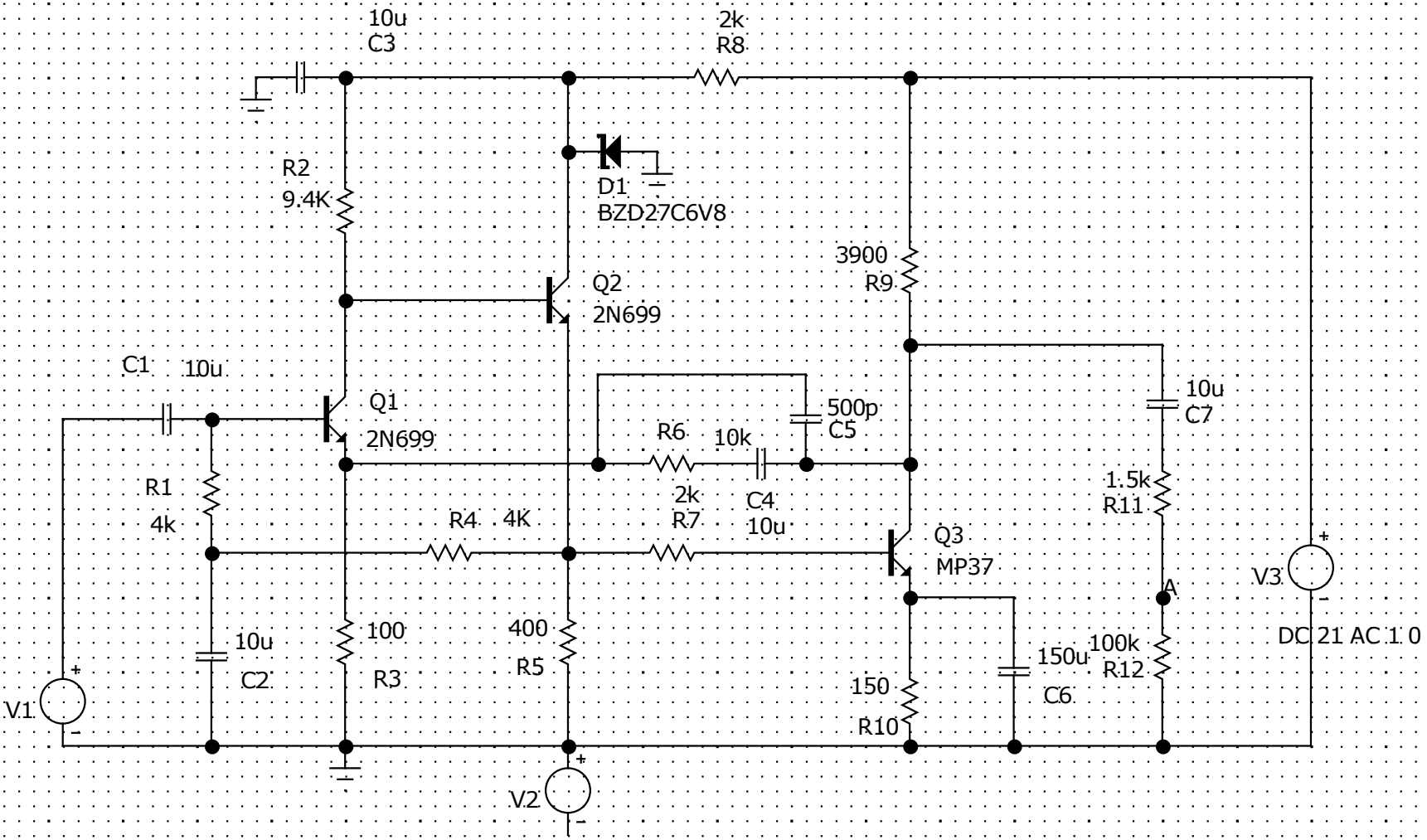
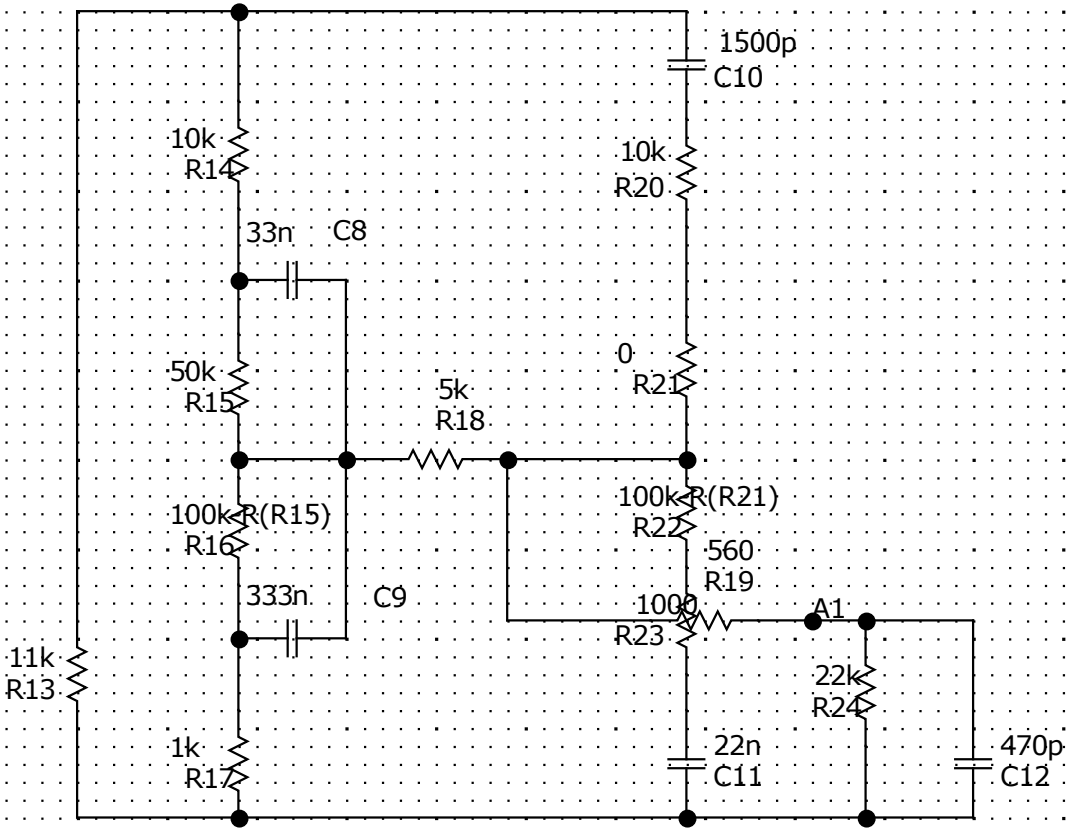

10u
C3
2k
R8
R2
9.4K
D1
BZD27C6V8
3900
R9
Q2
2N699
C1
10u
Q1
2N699
500p
C5
10u
C7
R6
10k
R1
4k
2k
R7
C4
10u
1.5k
R11
R4
4K
Q3
MP37
A
V3
DC 21 AC 1 0
10u
C2
100
R3
400
R5
150u
C6
100k
R12
150
R10
V1
V2


1500p
C10
10k
R14
10k
R20
33n
C8
0
R21
50k
R15
5k
R18
100k
R(R15)
R16
100k
R(R21)
R22
560
R19
333n
C9
100
R23
A1
11k
R13
22k
R24
1k
R17
22n
C11
470p
C12

```
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N2221 NPN (BF=112.57 BR=171.222m CJC=36.6437p CJE=42.4239p IKF=314.795m
+ IKR=476.235 IS=10.017f ISC=2.93412p ISE=955.182f ITF=10.2871m MJC=558.066m
+ MJE=642.887m NE=1.61283 NF=979.99m RE=668.817m TF=407.084p TR=2.30117u
+ VAF=100 VJC=700m VJE=700m VTF=10 XTF=500.021m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Amplifier transistor
.MODEL 2N2102 NPN (BF=129.061 BR=5 CJC=27.4829p CJE=70.7065p IKF=212.238m
+ IKR=990.688 IS=9.99994f ISC=.0332463f ISE=967.242f ITF=9.62885m MJC=558.067m
+ MJE=642.888m NE=1.64936 NF=1.00011 RE=634.829m TF=2.04771n TR=10n VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=499.994m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Amplifier transistor
.MODEL 2N930 NPN (BF=316.518 BR=6.51708m CJC=26.533p CJE=2p IKF=10K IKR=478.625
+ IS=10.1652f ISC=.00502062f ISE=418.098f ITF=11.6236m MJC=571.784m MJE=500m
+ NE=2.36712 NF=1.23211 RC=1.84317 RE=1.99985 TF=4.64885n TR=10n VAF=100
+ VJC=700.227m VTF=10 XTF=500.104m)
*** From file C:\MC12\library\DIODESINC_BJT.LIB
.MODEL 2DD2661 NPN (BF=500 BR=280 CJC=76E-12 CJE=230E-12 IKF=5 IKR=2
+ IS=5.92E-13 ISC=6.138E-13 ISE=1.27E-13 MJC=0.2981 MJE=0.3569 NC=1.46 NE=1.425
+ RB=0.1 RC=0.017 RE=0.025 TF=1.12E-9 TR=2.15E-9 VAF=34.6 VAR=12.25 VJC=0.4414
+ VJE=0.7042)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N3904 NPN (BF=326.427 BR=528.632m CJC=3.66441p CJE=4.42095p
+ IKF=26.7378m IKR=980.247 IS=10.0184f ISC=100p ISE=999.933f ITF=10.1029m
+ MJC=300m MJE=423.145m NE=1.72338 NF=1.01772 RE=1.47525 TF=477.297p
+ TR=595.818n VAF=101.811 VJC=700.503m VJE=1 VTF=10 XTF=500.027m)
*** From file C:\MC12\library\MPBJT.LIB
.MODEL 2N3902 NPN (BF=176.356735823918 BR=3.69574M CJC=624.394114710067P
+ CJE=2.015569036397N IKF=1 IKR=1 IS=10F ISC=99.97435802925P
+ ISE=98.387499342776P ITF=4.707796397425M MJC=477.132998205114M
+ MJE=344.105161241485M NC=2.000000006853 NE=1.586117119607
+ NF=925.204910017884M RC=242.624099308175M RE=78.018214108901M
+ TF=45.498744919616N TR=1.1M VAF=100 VJC=700.187716434702M VTF=10.000000760189
+ XTF=500.00502269597M)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Amplifer transistors
.MODEL BC546B NPN (BF=294.402 BR=2.65875 CJC=6.40421p CJE=19.7395p IKF=139.796m
+ IKR=997.583 IS=7.88857f ISC=3.45105p ISE=997.415f ITF=9.88981m MJC=316.254m
+ MJE=312.92m NE=1.93976 NF=968.124m RE=1.23191 TF=374.789p TR=10n VAF=100
+ VJC=700m VJE=770.586m VTF=10 XTF=499.98m)
*** From file C:\MC12\library\CS.LIB
.MODEL 2N3866 NPN (BF=1.2948E3 BR=1.0408 CJC=7.3111E-12 CJE=31.375E-12
+ IKF=.13116 IKR=3.3880 IS=13.232E-12 ISC=13.232E-12 ISE=785.43E-12 ITF=5.8742
```

```
+ MJC=.30725 MJE=.31831 NC=1.4860 NE=1.7362 NK=.72187 RB=8.9057 RC=1.7862
+ TF=178.96E-12 TR=10.000E-9 VAF=100 VAR=100 VJC=.76419 VJE=.87558 VTF=10.275
+ XTF=10.044)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Amplifer transistors
.MODEL BC547 NPN (BF=437.641 BR=2.55977 CJC=6.40421p CJE=19.7395p IKF=544.354m
+ IKR=985.432 IS=7.88857f ISC=7.52015p ISE=.0000161327f ITF=9.88981m
+ MJC=316.254m MJE=312.92m NE=1.24119 NF=968.124m RE=1.23191 TF=374.789p TR=10n
+ VAF=100 VJC=700m VJE=770.586m VTF=10 XTF=499.98m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Amplifer transistors
.MODEL BC546A NPN (BF=190.796 BR=2.79335 CJC=6.40421p CJE=19.7395p IKF=151.395m
+ IKR=995.974 IS=7.88857f ISC=2.06975p ISE=1.00306p ITF=9.88981m MJC=316.254m
+ MJE=312.92m NE=1.83871 NF=968.124m RE=1.23191 TF=374.789p TR=10n VAF=100
+ VJC=700m VJE=770.586m VTF=10 XTF=499.98m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Amplifer transistors
.MODEL BC547B NPN (BF=294.402 BR=2.65875 CJC=6.40421p CJE=19.7395p IKF=139.796m
+ IKR=997.583 IS=7.88857f ISC=3.45105p ISE=997.415f ITF=9.88981m MJC=316.254m
+ MJE=312.92m NE=1.93976 NF=968.124m RE=1.23191 TF=374.789p TR=10n VAF=100
+ VJC=700m VJE=770.586m VTF=10 XTF=499.98m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N2222 NPN (BF=200.601 BR=155.257m CJC=36.6437p CJE=42.4239p IKF=1.77131
+ IKR=995.298 IS=10.017f ISC=9.15251p ISE=999.157f ITF=10.2871m MJC=558.066m
+ MJE=642.887m NE=1.83441 NF=979.99m RE=668.817m TF=407.084p TR=2.26225u
+ VAF=100 VJC=700m VJE=700m VTF=10 XTF=500.021m)
*** From file C:\MC12\library\ROHM_TRANSISTOR.LIB
.MODEL UMT3904 NPN (BF=418.50 BR=1.4445 CJC=3.1745E-12 CJE=6.3252E-12
+ IKF=.11777 IKR=14.562 IS=7.8000E-15 ISC=71.780E-12 ISE=107.33E-15 ITF=10.142
+ MJC=.19463 MJE=.35786 NC=1.5919 NE=1.4561 NK=.73861 RB=7.1334 RC=.86215
+ TF=281.52E-12 TR=121.92E-9 VAF=210 VAR=16 VJC=.77077 VJE=.62919 VTF=945.94
+ XTB=1.5000 XTF=1.6571E3)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Low Noise Transistors
.MODEL BC550B NPN (BF=300.065 BR=3.20002 CJC=3.95759p CJE=6.98126p IKF=9.89822K
+ IKR=12.2322m IS=10.033f ISC=.167969f ISE=1.00222p ITF=9.95056m MJC=300m
+ MJE=334.494m NE=2.00964 NF=1.01548 RC=528.332m RE=2 TF=505.102p TR=10n
+ VAF=100 VJC=723.124m VJE=700m VTF=10 XTF=499.996m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Low Noise Transistors
.MODEL BC550C NPN (BF=1.40035K BR=3.14155 CJC=3.95759p CJE=6.98126p
+ IKF=822.977m IKR=12.3277m IS=10.033f ISC=185.988f ISE=.801633f ITF=9.95056m
+ MJC=300m MJE=334.494m NE=1.20403 NF=1.01548 RC=521.018m RE=2 TF=505.102p
+ TR=10n VAF=100 VJC=723.124m VJE=700m VTF=10 XTF=499.996m)
*** From file C:\MC12\library\MSBJT.LBR
```

```
*** NPN Low Noise Transistors
.MODEL BC550A NPN (BF=200.001 BR=3.38466 CJC=3.95759p CJE=6.98126p IKF=999.996m
+ IKR=12.5036m IS=10.033f ISC=122.001f ISE=986.178f ITF=9.95056m MJC=300m
+ MJE=334.494m NE=1.78895 NF=1.01548 RC=523.976m RE=2 TF=505.102p TR=10n
+ VAF=100 VJC=723.124m VJE=700m VTF=10 XTF=499.996m)
*** From file C:\MC12\library\EUROPE.LBR
*** NPN AF transistor
.MODEL BC107B NPN (BF=280.636505 BR=161.258996m CJC=6.117156p CJE=11.826276p
+ IKF=9.99853K IKR=997.461426 IS=10.00035f ISC=.0002724251f ISE=87.422097p
+ ITF=9.95368m MJC=361.359m MJE=673.545003m NE=3 NF=912.846446m RC=55.998243m
+ RE=2 TF=395.633026p TR=10n VAF=62.366673 VJC=949.695349m VJE=1 VTF=10
+ XTF=500.000119m)
*** From file C:\MC12\library\EUROPE.LBR
*** NPN AF transistor
.MODEL BC108A NPN (BF=201.511795 BR=165.146813m CJC=6.117149p CJE=11.82627p
+ IKF=10K IKR=84.490936 IS=10.00035f ISC=4.707919f ISE=1.02365p ITF=9.95368m
+ MJC=361.358643m MJE=673.545063m NE=1.665544 NF=912.846446m RE=2
+ TF=395.633026p TR=10n VAF=106.811111 VJC=949.695349m VJE=1 VTF=10
+ XTF=500.000119m)
*** From file C:\MC12\library\EUROPE.LBR
*** NPN AF transistor
.MODEL BC109B NPN (BF=242.854111 BR=161.449686m CJC=6.117149p CJE=11.82627p
+ IKF=10K IKR=21.026285 IS=10.00035f ISC=6.657168f ISE=1.009243p ITF=9.95368m
+ MJC=361.358643m MJE=673.545063m NE=1.809951 NF=912.846446m RE=2
+ TF=395.633026p TR=10n VAF=62.366673 VJC=949.695349m VJE=1 VTF=10
+ XTF=500.000119m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Ampilifier transistors
.MODEL BC317A NPN (BF=190.149 BR=3.18456 CJC=11.451p CJE=16.2625p IKF=889.685m
+ IKR=1.00042 IS=10.0976f ISC=5.85854p ISE=999.82f ITF=10.0329m MJC=558.062m
+ MJE=642.885m NE=1.81194 NF=965.459m RE=1.02781 TF=384.717p TR=10n VAF=95.7
+ VJC=700m VJE=700m VTF=10 XTF=500.001m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Ampilifier transistors
.MODEL BC337 NPN (BF=402.003 BR=2.59304 CJC=11.5113p CJE=34.193p IKF=978.012m
+ IKR=594.204 IS=10.0039f ISC=4.59297f ISE=.000000121848f ITF=9.88943m
+ MJC=391.345m MJE=370.304m NE=2.9896 NF=988.174m RE=418.399m TF=500.788p
+ TR=10n VAF=100 VJC=700m VJE=752.182m VTF=10 XTF=500.013m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Low Noise transistors
.MODEL BC413 NPN (BF=336.323 BR=49.2023m CJC=11.451p CJE=2p IKF=1.32521
+ IKR=1.08058 IS=10.0995f ISC=25.155p ISE=.00001504629f ITF=9.99217m
+ MJC=558.062m MJE=500m NE=1.45995 NF=1.16287 RC=1.99454 RE=2 TF=514.776p
+ TR=10n VAF=100 VJC=700m VTF=10 XTF=500m)
*** From file C:\MC12\library\ZETEX.LIB
.MODEL BCP56-16_ZX NPN (BF=250 BR=30 CJC=15.9E-12 CJE=108E-12 GAMMA=5E-9
```

```
+ IKF=0.9 IKR=0.5 IS=6E-14 ISC=1.2E-13 ISE=1E-14 MJC=0.4 MJE=0.35 NC=1.2 NE=1.2
+ NF=0.99 NK=0.7 NR=0.98 QUASIMOD=1 RB=0.2 RC=0.08 RCO=5 RE=0.08 TF=0.8E-9
+ TR=55E-9 VAF=270 VAR=27 VJC=0.51 VJE=0.7 XTB=1.4)
*** From file C:\MC12\library\NXP.LIB
.MODEL BCV63 NPN (BF=324.4 BR=8.29 CJC=3.347E-12 CJE=1.244E-11 FC=0.979
+ IKF=0.109 IKR=0.09 IRB=5E-06 IS=1.822E-14 ISC=9.982E-12 ISE=2.894E-16
+ ITF=0.3131 MJC=0.391 MJE=0.3656 MJS=0.333 NC=1.763 NE=1.4 NF=0.9932 NR=0.9931
+ RB=10 RBM=5 RC=0.7014 RE=0.649 TF=4.908E-10 TR=9E-08 VAF=82 VAR=17.9
+ VJC=0.5463 VJE=0.7579 VJS=0.75 VTF=2.927 XCJC=0.6193 XTF=9.51)
*** From file C:\MC12\library\EUROPE.LBR
*** NPN General Purpose Transistor
.MODEL BCW31 NPN (BF=224.120575 BR=803.002179m CJC=7.151779p CJE=2p
+ IKF=77.856183m IKR=10.000083m IS=9.999513f ISC=32.229177f ISE=996.152921f
+ ITF=9.907999m MJC=449.390113m MJE=500m NE=1.746772 NF=999.655008m
+ RC=145.466104m RE=1.654509 TF=431.503444p TR=10n VAF=100 VJC=699.999988m
+ VTF=10 XTF=500.017583m)
*** From file C:\MC12\library\INFINEON.LIB
.MODEL BCX54 NPN (AF=1.00E+00 BF=1.29E+02 BR=2.92E+00 CJC=4.85E-11 CJE=1.17E-10
+ CJS=0.00E+00 EG=1.11E+00 FC=5.00E-01 IKF=9.06E-01 IKR=1.00E+00 IRB=2.38E-02
+ IS=3.06E-15 ISC=4.08E-14 ISE=1.62E-16 ITF=5.64E-01 KF=0.00E+00 MJC=5.09E-01
+ MJE=4.22E-01 MJS=3.30E-01 NC=1.00E+00 NE=1.00E+00 NF=8.55E-01 NR=9.10E-01
+ PTF=0.00E+00 RB=1.65E+01 RBM=1.73E-02 RC=3.11E-01 RE=1.26E-02 TF=1.42E-09
+ TR=0.00E+00 VAF=7.24E+02 VAR=5.46E+01 VJC=3.00E-01 VJE=3.00E-01 VJS=7.50E-01
+ VTF=9.99E+05 XCJC=1.00E+00 XTB=0.00E+00 XTF=7.75E-01 XTI=3.00E+00)
*** From file C:\MC12\library\PH_BJT.LIB
.MODEL BSR13 NPN (BF=256.7 BR=6.590 CJC=10.11E-12 CJE=25.89E-12 CJS=0.000
+ EG=1.110 FC=938.8E-3 IKF=489.9E-3 IKR=192.9E-3 IRB=1.000E-3 IS=29.13E-15
+ ISC=320.3E-12 ISE=9.652E-15 ITF=4.797 MJC=416.0E-3 MJE=366.8E-3 MJS=333.0E-3
+ NC=1.608 NE=1.516 NF=992.6E-3 NR=984.4E-3 PTF=0.000 RB=1.000 RBM=1.000
+ RC=224.8E-3 RE=193.4E-3 TF=293.9E-12 TR=320.0E-9 VAF=80.99 VAR=101.2
+ VJC=662.2E-3 VJE=689.1E-3 VJS=750.0E-3 VTF=20.00 XCJC=0.5946 XTB=0.000
+ XTF=71.78 XTI=3.000)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN 60V 500mA
.MODEL MPSA05 NPN (BF=826.794 BR=247.354m CJC=17.7143p CJE=54.5263p
+ IKF=75.5761m IKR=998.715 IS=10.0605f ISC=100p ISE=1.03564p ITF=10.3807m
+ MJC=308.249m MJE=382.441m NE=1.43501 NF=894.567m RE=180.651m TF=491.726p
+ TR=6.25476u VAF=100 VJC=700m VJE=757.195m VTF=10 XTF=500.057m)
*** From file C:\MC12\library\ZETEX.LIB
.MODEL ZXTN19060CG NPN (BF=375 BR=65 CJC=62E-12 CJE=379E-12 GAMMA=1.6E-8 IKF=9
+ IKR=.12 IS=6E-13 ISC=3E-13 ISE=7E-14 MJC=0.38 MJE=0.38 NC=1.27 NE=1.42
+ QUASIMOD=1 RB=0.17 RC=0.005 RCO=1.1 RE=0.007 TF=10E-10 TR=2.5E-8 TRB1=.01
+ TRC1=.01 TRE1=.01 VAF=176 VAR=23.3 VJC=0.51 VJE=0.8 XTB=1.4)
*** From file C:\MC12\library\ZETEX.LIB
.MODEL ZXTN19020DG NPN (BF=530 BR=174 CJC=89E-12 CJE=365E-12 GAMMA=0.3E-9 IKF=6
+ IKR=1 IS=9E-13 ISC=4E-13 ISE=8E-14 MJC=0.34 MJE=0.39 NC=1.37 NE=1.4
```

```
+ QUASIMOD=1 RB=0.17 RC=0.0035 RCO=0.15 RE=0.0055 TF=9E-10 TR=0.55E-8 TRB1=.005
+ TRC1=.005 TRE1=.005 VAF=105 VAR=12.8 VJC=0.51 VJE=0.8 XTB=1.4)
*** From file C:\MC12\library\ZETEX.LIB
.MODEL ZXTN19020CFF NPN (BF=400 BR=163 CJC=98E-12 CJE=379E-12 GAMMA=1E-9 IKF=9
+ IKR=1 IS=5.9E-13 ISC=4E-13 ISE=9E-14 MJC=0.29 MJE=0.38 NC=1.38 NE=1.42
+ QUASIMOD=1 RB=.17 RC=.0025 RCO=0.15 RE=.005 TF=9E-10 TR=0.55E-8 TRB1=.01
+ TRC1=.01 TRE1=.01 VAF=117 VAR=15.2 VJC=0.46 VJE=0.8 XTB=1.4)
*** From file C:\MC12\library\ZETEX.LIB
.MODEL ZTX453 NPN (BF=150 BR=6 CJC=18E-12 CJE=65E-12 GAMMA=1E-7 IKF=2 IKR=1.8
+ IS=3.8E-14 ISC=5E-13 ISE=1E-14 MJC=0.31 MJE=0.34 NC=1.2 NE=1.22 NF=1.008
+ NR=1.015 QUASIMOD=1 RB=1 RC=0.061 RCO=17 RE=0.155 TF=8E-10 TR=6E-7 VAF=300
+ VAR=48 VJC=0.45 VJE=0.7 VO=20 XTB=1.4)
*** From file C:\MC12\library\DIODESINC_BJT.LIB
.MODEL 2DC2412R NPN (BF=524 BR=4.00 CJC=7.34P CJE=22.7P EG=1.12 IKF=54.7M
+ IKR=0.135 IS=15.5F ISE=3.90P MJC=0.300 MJE=0.500 NE=2.00 NF=1.00 NR=1.00
+ RB=1.16 RC=0.116 RE=0.290 TF=698P TR=121N VAF=127 VAR=28.0 VJC=0.300 VJE=1.10
+ XTB=1.5)
*** From file C:\MC12\library\DIODESINC_BJT.LIB
.MODEL 2DC4617QLP NPN (BF=202 BR=4.00 CJC=6.12P CJE=15.6P EG=1.12 IKF=98.0M
+ IKR=0.150 IS=1.21F ISE=5.55F MJC=0.300 MJE=0.500 NE=2.00 NF=1.00 NR=1.00
+ RB=2.30 RC=0.230 RE=0.575 TF=765P TR=126N VAF=127 VAR=20.0 VJC=0.300 VJE=1.10
+ XTB=1.5)
*** From file C:\MC12\library\DIODESINC_BJT.LIB
.MODEL 2DC4617R NPN (BF=524 BR=4.00 CJC=7.34P CJE=22.7P EG=1.12 IKF=54.7M
+ IKR=0.135 IS=15.5F ISE=3.90P MJC=0.300 MJE=0.500 NE=2.00 NF=1.00 NR=1.00
+ RB=1.16 RC=0.116 RE=0.290 TF=698P TR=121N VAF=127 VAR=28.0 VJC=0.300 VJE=1.10
+ XTB=1.5)
*** From file C:\MC12\library\DIODESINC_BJT.LIB
.MODEL 2DC4672 NPN (BF=230 BR=56 CJC=51E-12 CJE=318E-12 IKF=2 IKR=1
+ IS=2.218E-13 ISC=2.971E-13 ISE=2.9E-14 MJC=.42 NC=1.321 NE=1.35 NF=.9956
+ NR=.995 RB=.04 RC=.069 RE=.075 TF=.77E-9 TR=27E-9 VAF=100 VAR=30 VJC=.595)
*** From file C:\MC12\library\DIODESINC_BJT.LIB
.MODEL 2DD1766Q NPN (BF=201 BR=4.00 CJC=41.4P CJE=218P EG=1.12 IKF=2.97
+ IKR=4.50 IS=6.65F ISE=13.0F MJC=0.300 MJE=0.500 NE=2.00 NF=1.00 NR=1.00
+ RB=0.275 RC=27.5M RE=68.7M TF=538P TR=101N VAF=102 VAR=20.0 VJC=0.300
+ VJE=1.10 XTB=1.5)
*** From file C:\MC12\library\DIODESINC_BJT.LIB
.MODEL 2DD2652 NPN (BF=550 BR=280 CJC=34.2E-12 CJE=103.5E-12 IKF=2.25 IKR=0.9
+ IS=2.66E-13 ISC=2.76E-13 ISE=5.7E-14 MJC=0.298 MJE=0.357 NC=1.46 NE=1.425
+ RB=0.22 RC=0.038 RE=0.055 TF=1.12E-9 TR=2.15E-9 VAF=34.6 VAR=12.25 VJC=0.441
+ VJE=0.7042)
*** From file C:\MC12\library\DIODESINC_BJT.LIB
.MODEL 2DD2656 NPN (BF=550 BR=110 CJC=18E-12 CJE=97.7E-12 IKF=0.99 IKR=0.63
+ IS=2.61E-13 ISC=2.25E-12 ISE=7.17E-14 MJC=0.371 NC=1.45 NE=1.4148 RB=0.093
+ RC=0.083 RE=0.073 TF=0.78E-9 TR=9E-9 VAF=84 VAR=51 VJC=0.435)
*** From file C:\MC12\library\DIODESINC_BJT.LIB
```

```
.MODEL 2DD2678 NPN (BF=500 BR=280 CJC=76E-12 CJE=230E-12 IKF=5 IKR=2
+ IS=5.92E-13 ISC=6.138E-13 ISE=1.27E-13 MJC=0.2981 MJE=0.3569 NC=1.46 NE=1.425
+ RB=0.1 RC=0.017 RE=0.025 TF=1.12E-9 TR=2.15E-9 VAF=34.6 VAR=12.25 VJC=0.4414
+ VJE=0.7042)
*** From file C:\MC12\library\DIODESINC_BJT.LIB
.MODEL 2DD2679 NPN (BF=480 BR=65 CJC=35E-12 CJE=192E-12 GAMMA=1E-8 IKF=3.3
+ IKR=1 IS=5.1E-13 ISC=1.1E-13 ISE=1.2E-13 MJC=0.34 MJE=0.38 NC=1.31 NE=1.49
+ QUASIMOD=1 RB=0.15 RC=0.012 RCO=1.9 RE=0.0115 TF=0.62E-9 TR=20E-9 TRB1=0.005
+ TRC1=0.005 TRE1=0.005 VAF=99 VAR=24 VJC=0.47 VJE=0.75 XTB=1.35)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N699 NPN (BF=89.1701 BR=4.99999 CJC=66.3325p CJE=2p IKF=149.835m
+ IKR=209.192 IS=10.2451f ISC=6.29099f ISE=948.549f ITF=10.1413m MJC=571.784m
+ MJE=500m NE=2.04347 NF=1.27541 RE=2 TF=2.5418n TR=10n VAF=100 VJC=700.227m
+ VTF=10 XTF=499.998m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistors
.MODEL 2N706 NPN (BF=47.9243 BR=1m CJC=27.4829p CJE=2p IKF=752.796m IKR=10m
+ IS=10.1652f ISC=100p ISE=977.355f ITF=10.0415m MJC=558.067m MJE=500m
+ NE=1.94587 NF=1.23211 RC=2 RE=1.99985 TF=671.676p TR=102.03u VAF=100 VJC=700m
+ VTF=10 XTF=500.01m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistors
.MODEL 2N706A NPN (BF=47.9243 BR=1m CJC=27.4829p CJE=2p IKF=752.796m IKR=10m
+ IS=10.1652f ISC=100p ISE=977.355f ITF=10.0415m MJC=558.067m MJE=500m
+ NE=1.94587 NF=1.23211 RC=2 RE=1.99985 TF=671.676p TR=102.03u VAF=100 VJC=700m
+ VTF=10 XTF=500.01m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistors
.MODEL 2N706B NPN (BF=47.9243 BR=9.017m CJC=27.4829p CJE=2p IKF=752.796m
+ IKR=683.825m IS=10.1652f ISC=33.5775p ISE=977.355f ITF=10.0415m MJC=558.067m
+ MJE=500m NE=1.94587 NF=1.23211 RC=1.98602 RE=1.99985 TF=671.676p TR=5.74343u
+ VAF=100 VJC=700m VTF=10 XTF=500.01m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistors
.MODEL 2N708 NPN (BF=86.8226 BR=1m CJC=27.4829p CJE=2p IKF=727.628m IKR=10m
+ IS=9.92443f ISC=100p ISE=958.901f ITF=10.076m MJC=558.067m MJE=500m
+ NE=1.80874 NF=1.09115 RC=2 RE=2 TF=677.015p TR=85.5963u VAF=100 VJC=700m
+ VTF=10 XTF=500.014m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N718 NPN (BF=107.679 BR=1m CJC=160.315p CJE=113.13p IKF=407.674m
+ IKR=10m IS=10.2451f ISC=100p ISE=825.424f ITF=10m MJC=558.064m MJE=642.884m
+ NE=2.03783 NF=1.27541 RC=2 RE=2 TF=1n TR=10n VAF=100 VJC=700m VJE=700m VTF=10
+ XTF=500m)
*** From file C:\MC12\library\MSBJT.LBR
```

```
*** NPN General purpose transistor
.MODEL 2N718A NPN (BF=118.143 BR=1m CJC=114.512p CJE=113.13p IKF=431.76m
+ IKR=10m IS=10.2451f ISC=100p ISE=994.232f ITF=8.23829m MJC=558.067m
+ MJE=642.884m NE=2.16858 NF=1.27541 RC=2 RE=2 TF=423.387p TR=10n VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=500.022m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N720A NPN (BF=112.851 BR=1m CJC=68.7063p CJE=120.201p IKF=279.599m
+ IKR=10m IS=10.0319f ISC=100p ISE=993.7f ITF=9.51244m MJC=558.063m
+ MJE=642.887m NE=1.81721 NF=1.05793 RC=2 RE=2 TF=2.39678n TR=10n VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=500.007m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistor
.MODEL 2N835 NPN (BF=60.0903 BR=3.18343 CJC=18.3219p CJE=2p IKF=706.589m
+ IKR=10m IS=10.1652f ISC=.00737411f ISE=975.828f ITF=10.2747m MJC=558.067m
+ MJE=500m NE=1.96955 NF=1.23211 RC=1.02125 RE=1.99985 TF=360.224p TR=23.4826n
+ VAF=100 VJC=700m VTF=10 XTF=500.009m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N1711 NPN (BF=239.252 BR=1m CJC=18.3219p CJE=28.2826p IKF=463.297m
+ IKR=10m IS=10.2451f ISC=100p ISE=3.74265p ITF=10.0289m MJC=558.067m
+ MJE=642.886m NE=2.82589 NF=1.27541 RC=2 RE=2 TF=373.344p TR=10n VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=500m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N1893 NPN (BF=129.29 BR=1m CJC=68.7063p CJE=120.201p IKF=212.428m
+ IKR=10m IS=10.0319f ISC=100p ISE=987.588f ITF=9.51244m MJC=558.063m
+ MJE=642.887m NE=1.74586 NF=1.05793 RC=2 RE=2 TF=2.39678n TR=10n VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=500.007m)
*** From file C:\MC12\library\ONSEMI.LIB
.MODEL 2N2102_ON NPN (BF=79.3546 BR=3.76239 CJC=1.3035E-11 CJE=1E-11 EG=1.05
+ FC=0.5 IKF=0.640083 IKR=2.76346 IRB=0.1 IS=1.1791E-10 ISC=3.24999E-13
+ ISE=7.91563E-12 ITF=0.01 MJC=0.23 MJE=0.33 MJS=0.5 NC=3.96875 NE=3.31476
+ NF=1.42901 NR=1.5 RB=0.1 RBM=0.1 RC=0.38569 RE=0.00431604 TF=1E-09 TR=1E-07
+ VAF=30.134 VAR=3.69384 VJC=0.62509 VJE=0.75 VJS=0.75 VTF=10 XCJC=0.9 XTB=0.1
+ XTF=1 XTI=1)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N2218 NPN (BF=112.57 BR=171.222m CJC=36.6437p CJE=42.4239p IKF=314.795m
+ IKR=476.235 IS=10.017f ISC=2.93412p ISE=955.182f ITF=10.2871m MJC=558.066m
+ MJE=642.887m NE=1.61283 NF=979.99m RE=668.817m TF=407.084p TR=2.30117u
+ VAF=100 VJC=700m VJE=700m VTF=10 XTF=500.021m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N2218A NPN (BF=112.57 BR=171.222m CJC=36.6437p CJE=35.3531p
+ IKF=314.795m IKR=476.235 IS=10.017f ISC=2.93412p ISE=955.182f ITF=10.0483m
```

```
+ MJC=558.066m MJE=642.88m NE=1.61283 NF=979.99m RE=668.817m TF=426.092p
+ TR=2.30117u VAF=100 VJC=700m VJE=700m VTF=10 XTF=499.996m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N2219 NPN (BF=200.641 BR=155.279m CJC=36.6437p CJE=42.4239p IKF=1.23677
+ IKR=990.687 IS=10.017f ISC=9.16426p ISE=999.947f ITF=10.2871m MJC=558.066m
+ MJE=642.887m NE=1.83449 NF=979.99m RE=668.817m TF=407.084p TR=2.26728u
+ VAF=100 VJC=700m VJE=700m VTF=10 XTF=500.021m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N1613 NPN (BF=190.621 BR=101.531m CJC=45.8046p CJE=70.7065p
+ IKF=99.9999m IKR=1.03984 IS=10.0011f ISC=323.578f ISE=99.2772p ITF=9.59122m
+ MJC=558.065m MJE=642.888m NE=1.93312 NF=994.027m RC=1.01683 TF=2.04682n
+ TR=10n VAF=100 VJC=700m VJE=700m VTF=10 XTF=499.996m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N956 NPN (BF=239.252 BR=1m CJC=18.3219p CJE=28.2826p IKF=463.297m
+ IKR=10m IS=10.2451f ISC=100p ISE=3.74265p ITF=10.0289m MJC=558.067m
+ MJE=642.886m NE=2.82589 NF=1.27541 RC=2 RE=2 TF=373.344p TR=10n VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=500m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N910 NPN (BF=166.182 BR=1m CJC=68.7063p CJE=120.201p IKF=395.236m
+ IKR=10m IS=9.98962f ISC=100p ISE=991.476f ITF=9.33493m MJC=558.063m
+ MJE=642.887m NE=1.92822 NF=1.10043 RC=2 RE=1.35482 TF=1.95793n TR=10n VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=500.007m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistor
.MODEL 2N914 NPN (BF=86.8226 BR=631.843m CJC=27.4829p CJE=12.7272p IKF=727.628m
+ IKR=1.00085 IS=9.92443f ISC=34.724p ISE=958.901f ITF=10.2348m MJC=558.067m
+ MJE=642.886m NE=1.80874 NF=1.09115 RC=500m RE=2 TF=394.065p TR=46.8968n
+ VAF=100 VJC=700m VJE=700m VTF=10 XTF=500.011m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N915 NPN (BF=139.213 BR=1m CJC=3.5p CJE=2p FC=501.9m IKF=808.43m
+ IKR=10m IS=10.1652f ISC=100p ISE=992.595f ITF=10m MJC=501.9m MJE=500m
+ NE=2.10611 NF=1.23211 RC=2 RE=1.99985 TF=1n TR=10n VAF=100 VJC=700m VTF=10
+ XTF=500m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N916 NPN (BF=146.036 BR=1m CJC=19.8997p CJE=14.1412p IKF=867.28m
+ IKR=10m IS=10.1652f ISC=100p ISE=993.687f ITF=10m MJC=571.783m MJE=642.878m
+ NE=2.10134 NF=1.23211 RC=2 RE=1.99985 TF=1n TR=10n VAF=100 VJC=700.228m
+ VJE=700m VTF=10 XTF=500m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Amplifier transistor
```

```
.MODEL 2N918 NPN (BF=199.631 BR=219.479m CJC=7.78681p CJE=2.82826p IKF=1.00006
+ IKR=995.4m IS=9.65895f ISC=3.55928p ISE=807.101f ITF=9.88227m MJC=558.067m
+ MJE=642.887m NE=2 NF=1.3696 RC=500m RE=1.99896 TF=158.837p TR=10n VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=500.003m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Amplifier transistor
.MODEL 2N930A NPN (BF=316.518 BR=6.51708m CJC=19.8997p CJE=2p IKF=10K
+ IKR=478.625 IS=10.1652f ISC=.00502062f ISE=418.098f ITF=9.81926m MJC=571.783m
+ MJE=500m NE=2.36712 NF=1.23211 RC=1.84317 RE=1.99985 TF=2.97408n TR=10n
+ VAF=100 VJC=700.228m VTF=10 XTF=499.972m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N2219A NPN (BF=200.601 BR=155.257m CJC=36.6437p CJE=35.3531p
+ IKF=1.77131 IKR=995.298 IS=10.017f ISC=9.15251p ISE=999.157f ITF=9.91019m
+ MJC=558.066m MJE=642.88m NE=1.83441 NF=979.99m RE=668.817m TF=336.941p
+ TR=2.26304u VAF=100 VJC=700m VJE=700m VTF=10 XTF=499.994m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N2221A NPN (BF=112.57 BR=171.222m CJC=36.6437p CJE=35.3531p
+ IKF=314.795m IKR=476.235 IS=10.017f ISC=2.93412p ISE=955.182f ITF=10.0483m
+ MJC=558.066m MJE=642.88m NE=1.61283 NF=979.99m RE=668.817m TF=426.092p
+ TR=2.30117u VAF=100 VJC=700m VJE=700m VTF=10 XTF=499.996m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N2222A NPN (BF=200.601 BR=155.257m CJC=36.6437p CJE=35.3531p
+ IKF=1.77131 IKR=995.298 IS=10.017f ISC=9.15251p ISE=999.157f ITF=9.91019m
+ MJC=558.066m MJE=642.88m NE=1.83441 NF=979.99m RE=668.817m TF=336.941p
+ TR=2.26304u VAF=100 VJC=700m VJE=700m VTF=10 XTF=499.994m)
*** From file C:\MC12\library\CS.LIB
.MODEL 2N2222AUB NPN (BF=240 BR=4.00 CJC=12.4P CJE=24.9P EG=1.12 IKF=0.293
+ IKR=0.600 IS=2.20F ISE=2.73P MJC=0.300 MJE=0.500 NE=2.00 NF=1.00 NR=1.00
+ RB=0.777 RC=77.7M RE=0.194 TF=371P TR=64.0N VAF=114 VAR=24.0 VJC=0.300
+ VJE=1.10 XTB=1.5)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Amplifier transistor
.MODEL 2N2270 NPN (BF=159.22 BR=3.25509 CJC=45.8046p CJE=84.8478p IKF=993.683m
+ IKR=1.00146 IS=9.99994f ISC=47.3465p ISE=1.0086p ITF=10.6905m MJC=558.065m
+ MJE=642.888m NE=1.63047 NF=1.00011 RE=634.829m TF=411.916p TR=10n VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=499.987m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistor
.MODEL 2N2368 NPN (BF=199.98 BR=283.438m CJC=13.2665p CJE=6.9282p IKF=34.4419m
+ IKR=1.01213 IS=9.9361f ISC=15.3011p ISE=1.01303p ITF=9.94851m MJC=571.784m
+ MJE=619.259m NE=1.80128 NF=1.16114 RC=500m RE=1.99992 TF=291.314p TR=77.781n
+ VAF=100 VJC=700.227m VJE=700.316m VTF=10 XTF=500m)
*** From file C:\MC12\library\MSBJT.LBR
```

```
*** NPN Switching transistor
.MODEL 2N2369 NPN (BF=199.98 BR=283.438m CJC=13.2665p CJE=6.9282p IKF=34.4419m
+ IKR=1.01213 IS=9.9361f ISC=15.3011p ISE=1.01303p ITF=10.1405m MJC=571.784m
+ MJE=619.259m NE=1.80128 NF=1.16114 RC=500m RE=1.99992 TF=221.443p TR=78.1629n
+ VAF=100 VJC=700.227m VJE=700.316m VTF=10 XTF=499.991m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistor
.MODEL 2N2369A NPN (BF=199.98 BR=1.85142 CJC=13.2665p CJE=6.9282p IKF=34.4419m
+ IKR=992.554m IS=9.9361f ISC=6.25573p ISE=1.01303p ITF=10.1405m MJC=571.784m
+ MJE=619.259m NE=1.80128 NF=1.16114 RE=1.99992 TF=221.443p TR=12.0992n VAF=100
+ VJC=700.227m VJE=700.316m VTF=10 XTF=499.991m)
*** From file C:\MC12\library\CS.LIB
.MODEL 2N2405 NPN (BF=154 BR=4.00 CJC=26.0P CJE=62.2P EG=1.12 IKF=0.500
+ IKR=1.27 IS=101F ISE=117P MJC=0.300 MJE=0.500 NE=2.00 NF=1.00 NR=1.00
+ RB=0.486 RC=48.6M RE=0.121 TF=753P TR=129N VAF=161 VAR=28.0 VJC=0.300
+ VJE=1.10 XTB=1.5)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistor
.MODEL 2N2481 NPN (BF=199.715 BR=5 CJC=16.5831p CJE=9.89891p IKF=90.17m
+ IKR=987.344 IS=1.2785p ISC=.409897f ISE=1.04091p ITF=10m MJC=571.783m
+ MJE=642.889m NE=1.60519 NF=1.35781 RE=2 TF=1n TR=5.86644n VAF=100
+ VJC=700.227m VJE=700m VTF=10 XTF=500m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Amplifier transistor
.MODEL 2N2484 NPN (BF=343.481 BR=8.70075m CJC=9.94978p CJE=5.65652p IKF=88.725
+ IKR=11.4954m IS=9.99576f ISC=97.9252p ISE=6.53941p ITF=10m MJC=571.78m
+ MJE=642.887m NE=3 NF=1.09109 RC=2 RE=2 TF=1n TR=10n VAF=100 VJC=700.229m
+ VJE=700m VTF=10 XTF=500m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistor
.MODEL 2N2501 NPN (BF=164.451 BR=4.99998 CJC=18.3219p CJE=9.89891p IKF=71.2697m
+ IKR=992.174 IS=10.0913f ISC=99.9996p ISE=946.679f ITF=10.2069m MJC=558.067m
+ MJE=642.889m NE=1.9101 NF=1.19041 RE=2 TF=310.03p TR=4.31399n VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=499.939m)
*** From file C:\MC12\library\CS.LIB
.MODEL 2N2857 NPN (BF=296.182 BR=19.550 CJC=1.89423E-12 CJE=1.08982E-12
+ EG=1.06135 FC=0.1 IKF=0.00544635 IKR=0.0544635 IRB=0.478136 IS=1.55467E-17
+ ISC=1E-160 ISE=2.01913E-14 ITF=0.0010 MJC=0.23 MJE=0.230 MJS=0.50 NC=2.9688
+ NE=1.54276 NF=0.850014 NR=0.825166 RB=21.0221 RBM=0.1384250 RC=3.0552
+ RE=0.000646335 TF=2.15066E-11 TR=1E-07 VAF=10 VAR=73.1109 VJC=0.95 VJE=0.99
+ VJS=0.75 VTF=1.33967 XCJC=0.4084790 XTB=0.582018 XTF=1000 XTI=1)
*** From file C:\MC12\library\CS.LIB
.MODEL 2N2857UB NPN (BF=296.182 BR=19.550 CJC=1.89423E-12 CJE=1.08982E-12
+ EG=1.06135 FC=0.1 IKF=0.00544635 IKR=0.0544635 IRB=0.478136 IS=1.55467E-17
+ ISC=1E-160 ISE=2.01913E-14 ITF=0.0010 MJC=0.23 MJE=0.230 MJS=0.50 NC=2.9688
+ NE=1.54276 NF=0.850014 NR=0.825166 RB=21.0221 RBM=0.1384250 RC=3.0552
```

```
+ RE=0.000646335 TF=2.15066E-11 TR=1E-07 VAF=10 VAR=73.1109 VJC=0.95 VJE=0.99
+ VJS=0.75 VTF=1.33967 XCJC=0.4084790 XTB=0.582018 XTF=1000 XTI=1)
*** From file C:\MC12\library\CS.LIB
.MODEL 2N2916 NPN (BF=575 BR=4.00 CJC=8.24P CJE=14.0P EG=1.12 IKF=12.1M
+ IKR=30.0M IS=6.42F ISE=1.08P MJC=0.300 MJE=0.500 NE=2.00 NF=1.00 NR=1.00
+ RB=1.52 RC=0.152 RE=0.380 TF=434P TR=80.3N VAF=98.6 VAR=18.0 VJC=0.300
+ VJE=1.10 XTB=1.5)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistor
.MODEL 2N3011 NPN (BF=84.8663 BR=5 CJC=13.2665p CJE=113.13p IKF=604.802m
+ IKR=963.323 IS=9.89065f ISC=.0816535f ISE=872.942f ITF=20.8188K MJC=571.784m
+ MJE=642.884m NE=2.45987 NF=1.46634 RE=2 TF=.0005836323f TR=3.62864n VAF=100
+ VJC=700.227m VJE=700m VTF=81.3891 XTF=2.60831)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose transistor
.MODEL 2N3019 NPN (BF=230.82 BR=5 CJC=54.9657p CJE=84.8478p IKF=541.132m
+ IKR=994.106 IS=10.0235f ISC=.030062f ISE=10.1214f ITF=9.85324m MJC=558.067m
+ MJE=642.888m NE=1.75058 NF=1.01959 RE=2 TF=1.17383n TR=10n VAF=100 VJC=700m
+ VJE=700m VTF=10 XTF=500.001m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose transistor
.MODEL 2N3020 NPN (BF=199.956 BR=5 CJC=54.9657p CJE=84.8478p IKF=106.503m
+ IKR=320.274 IS=10.0235f ISC=.0120504f ISE=1.0342p ITF=9.52427m MJC=558.067m
+ MJE=642.888m NE=1.62796 NF=1.01959 RE=2 TF=1.4923n TR=10n VAF=100 VJC=700m
+ VJE=700m VTF=10 XTF=499.997m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose transistor
.MODEL 2N3053 NPN (BF=173.149 BR=37.14m CJC=68.7063p CJE=113.13p IKF=904.742m
+ IKR=228.429m IS=9.86921f ISC=99.4228p ISE=.0310706f ITF=10.0553m MJC=558.063m
+ MJE=642.884m NE=2.25735 NF=1.78337 RC=1.9728 RE=1.99998 TF=888.568p TR=10n
+ VAF=100 VJC=700m VJE=700m VTF=10 XTF=500.001m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose transistor
.MODEL 2N3053A NPN (BF=185.71 BR=1.68477 CJC=68.7063p CJE=113.13p IKF=413.66m
+ IKR=999.675m IS=9.99993f ISC=24.0801p ISE=990.642f ITF=9.42018m MJC=558.063m
+ MJE=642.884m NE=1.89084 NF=999.787m RE=1.43652 TF=1.14307n TR=10n VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=500.016m)
*** From file C:\MC12\library\MPBJT.LIB
.MODEL 2N3054 NPN (BF=153.47597185664 BR=20.074543923541M CJC=155.090027333211P
+ CJE=263.770948388189P FC=500.000000689595M IKF=607.618021810564M
+ IKR=996.576438476171 IS=9.515713199252F ISC=98.555827968388P
+ ISE=926.908248229621F ITF=11.269234820254M MJC=300.000000042459M
+ MJE=456.861753457561M NC=2.000000003546 NE=1.237073149436
+ NF=839.313185444086M RE=170.212781532508M TF=42.071825791901N
+ TR=95.78145725923U VAF=100 VJC=700.000000011081M VJE=951.9599378471M
+ VTF=10.000000025208 XTF=499.99979770608M)
```

```
*** From file C:\MC12\library\MPBJT.LIB
.MODEL 2N3054A NPN (BF=153.47597185664 BR=20.074543923541M
+ CJC=155.090027333211P CJE=263.770948388189P FC=500.000000689595M
+ IKF=607.618021810564M IKR=996.576438476171 IS=9.515713199252F
+ ISC=98.555827968388P ISE=926.908248229621F ITF=11.269234820254M
+ MJC=300.000000042459M MJE=456.861753457561M NC=2.000000003546
+ NE=1.237073149436 NF=839.313185444086M RE=170.212781532508M
+ TF=42.071825791901N TR=95.78145725923U VAF=100 VJC=700.000000011081M
+ VJE=951.9599378471M VTF=10.000000025208 XTF=499.99979770608M)
*** From file C:\MC12\library\ON_BJT.LIB
.MODEL 2N3055 NPN (BF=129.119 BR=1.01252 CJC=5E-10 CJE=9.03089E-08 EG=1.206
+ FC=0.661216 IKF=0.990922 IKR=2.70227 IRB=0.1 IS=2.37426E-14 ISC=2.47498E-10
+ ISE=2.47498E-10 ITF=0.987296 MJC=0.410238 MJE=0.59999 MJS=0.5 NC=2.90624
+ NE=1.89002 NF=0.85 NR=0.924456 RB=3.66609 RBM=0.1 RC=0.0764459 RE=0.000352673
+ TF=1E-08 TR=1E-07 VAF=31.1252 VAR=254.624 VJC=0.400243 VJE=0.513954 VJS=0.75
+ VTF=1.02605 XCJC=0.803124 XTB=1.34801 XTF=1.36696 XTI=1.07207)
*** From file C:\MC12\library\MPBJT.LIB
.MODEL 2N3055A NPN (BF=270.296090145107 BR=1.000000010767M
+ CJC=291.641045509903P CJE=501.999982363397P IKF=2.14332 IKR=10.000000445936M
+ IS=10.320472069268F ISC=99.9996P ISE=.000000208012F ITF=467.525969413682P
+ MJC=399.824326924171M MJE=531.887164864466M NC=2.000000005923
+ NE=615.576038043805M NF=848.945031884055M RC=30.930978501727M
+ RE=92.878898956575M TF=59.567523305522N TR=145.890713658539M VAF=100
+ VJC=700.01958693661M VJE=750.957730271836M VTF=10.002711491474
+ XTF=508.323610989927M)
*** From file C:\MC12\library\ON_BJT.LIB
.MODEL 2N3055H NPN (BF=129.119 BR=1.01252 CJC=5E-10 CJE=9.03089E-08 EG=1.206
+ FC=0.661216 IKF=0.990922 IKR=2.70227 IRB=0.1 IS=2.37426E-14 ISC=2.47498E-10
+ ISE=2.47498E-10 ITF=0.987296 MJC=0.410238 MJE=0.59999 MJS=0.5 NC=2.90624
+ NE=1.89002 NF=0.85 NR=0.924456 RB=3.66609 RBM=0.1 RC=0.0764459 RE=0.000352673
+ TF=1E-08 TR=1E-07 VAF=31.1252 VAR=254.624 VJC=0.400243 VJE=0.513954 VJS=0.75
+ VTF=1.02605 XCJC=0.803124 XTB=1.34801 XTF=1.36696 XTI=1.07207)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose transistor
.MODEL 2N3114 NPN (BF=91.3563 BR=1m CJC=57.6281p CJE=113.13p IKF=1.07657
+ IKR=10m IS=10.0774f ISC=100p ISE=997.283f ITF=10m MJC=548.293m MJE=642.884m
+ NE=1.65431 NF=1.0581 RC=2 RE=1.99999 TF=1n TR=10n VAF=100 VJC=700.235m
+ VJE=700m VTF=10 XTF=500m)
*** From file C:\MC12\library\CS.LIB
.MODEL 2N3117 NPN (BF=599.06 BR=10.364 CJC=5.3208E-12 CJE=11.658E-12 IKF=.76234
+ IKR=1.5810 IS=38.116E-15 ISC=803.76E-15 ISE=38.128E-15 ITF=1.6816 MJC=.29245
+ MJE=.46406 NC=1.5928 NE=1.9979 NK=1.2265 RB=9.7439 RC=.23381 TF=457.31E-12
+ TR=10.000E-9 VAF=100 VAR=100 VJC=.42236 VJE=1.2545 VTF=10.347 XTF=10.516)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistor
.MODEL 2N3227 NPN (BF=199.98 BR=1.85142 CJC=13.2665p CJE=6.9282p IKF=34.4419m
```

```
+ IKR=992.554m IS=9.9361f ISC=6.25573p ISE=1.01303p ITF=10.1405m MJC=571.784m
+ MJE=619.259m NE=1.80128 NF=1.16114 RE=1.99992 TF=221.443p TR=12.0992n VAF=100
+ VJC=700.227m VJE=700.316m VTF=10 XTF=499.991m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose transistor
.MODEL 2N3252 NPN (BF=189.788 BR=67.6131m CJC=54.9657p CJE=113.13p IKF=999.97m
+ IKR=10.3625 IS=10.0015f ISC=99.3494p ISE=1.04239p ITF=10.0701m MJC=558.067m
+ MJE=642.884m NE=1.44031 NF=999.107m RE=969.806m TF=506.537p TR=1.12087u
+ VAF=100 VJC=700m VJE=700m VTF=10 XTF=500m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose transistor
.MODEL 2N3253 NPN (BF=168.087 BR=10.1179m CJC=54.9657p CJE=113.13p IKF=997.552m
+ IKR=12.4896 IS=10.0015f ISC=99.9898p ISE=981.169f ITF=9.66481m MJC=558.067m
+ MJE=642.884m NE=1.42171 NF=999.107m RE=969.806m TF=597.35p TR=7.78512u
+ VAF=100 VJC=700m VJE=700m VTF=10 XTF=499.992m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose transistor
.MODEL 2N3300 NPN (BF=250.624 BR=4.99999 CJC=36.6437p CJE=44.6832p IKF=322.377m
+ IKR=323.659 IS=10.0056f ISC=.14003f ISE=1.43742p ITF=10.1146m MJC=558.066m
+ MJE=595.489m NE=1.7824 NF=1.0027 RE=1.65076 TF=460.697p TR=10n VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=499.998m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose transistor
.MODEL 2N3302 NPN (BF=250.624 BR=4.99999 CJC=36.6437p CJE=44.6832p IKF=322.377m
+ IKR=323.659 IS=10.0056f ISC=.14003f ISE=1.43742p ITF=10.1146m MJC=558.066m
+ MJE=595.489m NE=1.7824 NF=1.0027 RE=1.65076 TF=460.697p TR=10n VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=499.998m)
*** From file C:\MC12\library\FAIRCH.LIB
.MODEL 2N3390 NPN (BF=685.8 BR=4.379 CJC=5.777P CJE=8.307P FC=.5 IKF=.1072
+ IS=12.03F ISE=1.842P ITF=.17 MJC=.3199 MJE=.384 NE=1.971 RB=10 RC=1 TF=385.4P
+ TR=685.3P VAF=37.37 VJC=.75 VJE=.75 VTF=3 XTB=1.5 XTF=8)
*** From file C:\MC12\library\FAIRCH.LIB
.MODEL 2N3391A NPN (BF=427.8 BR=4.379 CJC=5.777P CJE=8.307P FC=.5 IKF=.1072
+ IS=12.03F ISE=2.953P ITF=.17 MJC=.3199 MJE=.384 NE=1.971 RB=10 RC=1 TF=385.4P
+ TR=701.7P VAF=37.37 VJC=.75 VJE=.75 VTF=3 XTB=1.5 XTF=8)
*** From file C:\MC12\library\FAIRCH.LIB
.MODEL 2N3392 NPN (BF=254.8 BR=4.379 CJC=5.777P CJE=8.307P FC=.5 IKF=.1072
+ IS=12.03F ISE=4.958P ITF=.17 MJC=.3199 MJE=.384 NE=1.971 RB=10 RC=1 TF=385.4P
+ TR=732.1P VAF=37.37 VJC=.75 VJE=.75 VTF=3 XTB=1.5 XTF=8)
*** From file C:\MC12\library\FAIRCH.LIB
.MODEL 2N3393 NPN (BF=154.1 BR=4.379 CJC=5.777P CJE=8.307P FC=.5 IKF=.1072
+ IS=12.03F ISE=8.195P ITF=.17 MJC=.3199 MJE=.384 NE=1.971 RB=10 RC=1 TF=385.4P
+ TR=783.8P VAF=37.37 VJC=.75 VJE=.75 VTF=3 XTB=1.5 XTF=8)
*** From file C:\MC12\library\FAIRCH.LIB
.MODEL 2N3415 NPN (BF=377.5 BR=4.379 CJC=5.777P CJE=8.307P FC=.5 IKF=.1072
+ IS=12.03F ISE=3.346P ITF=.17 MJC=.3199 MJE=.384 NE=1.971 RB=10 RC=1 TF=385.4P
```

```
+ TR=707.6P VAF=37.37 VJC=.75 VJE=.75 VTF=3 XTB=1.5 XTF=8)
*** From file C:\MC12\library\FAIRCH.LIB
.MODEL 2N3416 NPN (BF=157.3 BR=4.379 CJC=5.777P CJE=8.307P FC=.5 IKF=.1072
+ IS=12.03F ISE=8.031P ITF=.17 MJC=.3199 MJE=.384 NE=1.971 RB=10 RC=1 TF=385.4P
+ TR=781.1P VAF=37.37 VJC=.75 VJE=.75 VTF=3 XTB=1.5 XTF=8)
*** From file C:\MC12\library\FAIRCH.LIB
.MODEL 2N3417 NPN (BF=377.5 BR=4.379 CJC=5.777P CJE=8.307P FC=.5 IKF=.1072
+ IS=12.03F ISE=3.346P ITF=.17 MJC=.3199 MJE=.384 NE=1.971 RB=10 RC=1 TF=385.4P
+ TR=707.6P VAF=37.37 VJC=.75 VJE=.75 VTF=3 XTB=1.5 XTF=8)
*** From file C:\MC12\library\CS.LIB
.MODEL 2N3421 NPN (BF=831 BR=4.00 CJC=102P CJE=315P EG=1.12 IKF=0.733 IKR=7.50
+ IS=305F ISE=1.34N MJC=0.300 MJE=0.500 NE=2.00 NF=1.00 NR=1.00 RB=0.309
+ RC=30.9M RE=77.2M TF=1.76N TR=267N VAF=161 VAR=32.0 VJC=0.300 VJE=1.10
+ XTB=1.5)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN 350V 1A
.MODEL 2N3439 NPN (BF=239.069 BR=265.04m CJC=19.8784p CJE=108.211p FC=500.001m
+ IKF=10.5948m IKR=1.00891 IS=9.94996f ISC=4.89752p ISE=99.2945p ITF=1.75717p
+ MJC=317.349m MJE=432.698m NE=1.9593 NF=913.046m RE=329.989m TF=1n TR=14.2947u
+ VAF=100 VJC=700m VJE=999.674m VTF=9.96322 XTF=3.39469)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN 250V 1A
.MODEL 2N3440 NPN (BF=239.069 BR=265.04m CJC=19.8784p CJE=108.211p FC=500.001m
+ IKF=10.5948m IKR=1.00891 IS=9.94996f ISC=4.89752p ISE=99.2945p ITF=1.75717p
+ MJC=317.349m MJE=432.698m NE=1.9593 NF=913.046m RE=329.989m TF=1n TR=14.2947u
+ VAF=100 VJC=700m VJE=999.674m VTF=9.96322 XTF=3.39469)
*** From file C:\MC12\library\MPBJT.LIB
.MODEL 2N3441 NPN (BF=404.826134323433 BR=4.999980838217 CJC=5P CJE=2P
+ IKF=49.9413M IKR=999.749912896211 IS=10.072394610147F ISC=411.698649728659F
+ ISE=.000000201145F ITF=10M MJC=500M MJE=500M NC=2.000000004335
+ NE=2.999973377505 NF=1.512929986153 RE=1.999999953105 TF=1N TR=10N VAF=100
+ VTF=10 XTF=500M)
*** From file C:\MC12\library\MPBJT.LIB
.MODEL 2N3442 NPN (BF=267.105335760152 BR=4.999988756982 CJC=5P CJE=2P
+ IKF=523.051160815824M IKR=76.490821488311 IS=10.055888513862F
+ ISC=39.67754286554F ISE=1.202914231767P ITF=447.904034519576F MJC=500M
+ MJE=500M NC=2.000000002758 NE=1.744350362676 NF=977.484328413836M
+ RE=482.694329375647M TF=1.418258136775U TR=10N VAF=100 VTF=9.999605029532
+ XTF=500.947555843118M)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose transistor
.MODEL 2N3444 NPN (BF=138.038 BR=10.7861m CJC=54.9657p CJE=113.13p IKF=997.399m
+ IKR=50.9522 IS=10.0015f ISC=99.7459p ISE=1.00078p ITF=9.66481m MJC=558.067m
+ MJE=642.884m NE=1.40746 NF=999.107m RE=969.806m TF=597.35p TR=7.64785u
+ VAF=100 VJC=700m VJE=700m VTF=10 XTF=499.992m)
*** From file C:\MC12\library\MPBJT.LIB
```

```
.MODEL 2N3447 NPN (BF=1.999998974092K BR=74.013786216872M CJC=5P CJE=2P
+ IKF=1.151836985964 IKR=999.506162092369M IS=10.004802437488F
+ ISC=85.234542555396P ISE=9.588654009907P ITF=10M MJC=500M MJE=500M
+ NC=2.000000001182 NE=1.584666767103 NF=1.003090013008 RC=96.839240264944M
+ RE=24.384831293035M TF=1N TR=10N VAF=100 VTF=10 XTF=500M)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose Transistors
.MODEL 2N3498 NPN (BF=122.844 BR=176.367m CJC=45.8046p CJE=113.13p IKF=210.614m
+ IKR=44.5763 IS=9.98962f ISC=7.47302p ISE=995.128f ITF=9.86045m MJC=558.065m
+ MJE=642.884m NE=1.69525 NF=1.10043 RE=1.35482 TF=488.042p TR=8.363u VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=499.99m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose Transistors
.MODEL 2N3499 NPN (BF=196.024 BR=174.269m CJC=45.8046p CJE=113.13p IKF=99.9764m
+ IKR=986.599 IS=9.98962f ISC=14.2173p ISE=1.03167p ITF=9.86045m MJC=558.065m
+ MJE=642.884m NE=1.78405 NF=1.10043 RE=1.35482 TF=488.042p TR=8.06284u VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=499.99m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose Transistors
.MODEL 2N3500 NPN (BF=122.844 BR=176.367m CJC=36.6437p CJE=113.13p IKF=210.614m
+ IKR=44.5763 IS=9.98962f ISC=7.47302p ISE=995.128f ITF=10.0333m MJC=558.066m
+ MJE=642.884m NE=1.69525 NF=1.10043 RE=1.35482 TF=491.082p TR=8.363u VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=499.997m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose Transistors
.MODEL 2N3501 NPN (BF=196.024 BR=174.269m CJC=36.6437p CJE=113.13p IKF=99.9764m
+ IKR=986.599 IS=9.98962f ISC=14.2173p ISE=1.03167p ITF=10.0333m MJC=558.066m
+ MJE=642.884m NE=1.78405 NF=1.10043 RE=1.35482 TF=491.082p TR=8.06282u VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=499.997m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistors
.MODEL 2N3506 NPN (BF=199.954 BR=1.00001m CJC=183.218p CJE=793.459p
+ IKF=812.767m IKR=10.0001m IS=10.0052f ISC=99.9231p ISE=1.0645p ITF=14.9812m
+ MJC=558.066m MJE=584.153m NE=1.49625 NF=995.168m RC=73.2975m RE=376.252m
+ TF=1.56036n TR=14.9832m VAF=100 VJC=700m VJE=700m VTF=10 XTF=499.984m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistors
.MODEL 2N3507 NPN (BF=200.033 BR=1.10144m CJC=183.218p CJE=793.459p
+ IKF=476.022m IKR=10.0219m IS=10.0052f ISC=99.9959p ISE=956.408f ITF=14.9812m
+ MJC=558.066m MJE=584.153m NE=1.46435 NF=995.168m RC=68.278m RE=376.252m
+ TF=1.56036n TR=15.6283m VAF=100 VJC=700m VJE=700m VTF=10 XTF=499.984m)
*** From file C:\MC12\library\MPBJT.LIB
.MODEL 2N3583 NPN (BF=165.274675794119 BR=6.632930532115M CJC=147.622254185072P
+ CJE=750.714947333303P FC=500.000000591082M IKF=188.42211535203M
+ IKR=327.12185106126 IS=32.446322794815F ISC=99.999957108478P
+ ISE=1.005936551408P ITF=970.587903968311F MJC=397.017213039397M
```

```
+ MJE=511.923372766915M NC=2.000000003587 NE=1.242575861124
+ NF=849.771187453965M RC=77.30919622468M RE=167.336137584082M
+ TF=2.863916554465N TR=846.146257197563U VAF=100 VJC=700.000000003284M
+ VJE=999.999999947759M VTF=10.281210139556 XTF=419.951324004194M)
*** From file C:\MC12\library\MPBJT.LIB
.MODEL 2N3584 NPN (BF=165.274675794119 BR=6.632930532115M CJC=147.622254185072P
+ CJE=750.714947333303P FC=500.000000591082M IKF=188.42211535203M
+ IKR=327.12185106126 IS=32.446322794815F ISC=99.999957108478P
+ ISE=1.005936551408P ITF=970.587903968311F MJC=397.017213039397M
+ MJE=511.923372766915M NC=2.000000003587 NE=1.242575861124
+ NF=849.771187453965M RC=77.30919622468M RE=167.336137584082M
+ TF=2.863916554465N TR=846.146257197563U VAF=100 VJC=700.000000003284M
+ VJE=999.999999947759M VTF=10.281210139556 XTF=419.951324004194M)
*** From file C:\MC12\library\MPBJT.LIB
.MODEL 2N3585 NPN (BF=165.274675794119 BR=6.632930532115M CJC=147.622254185072P
+ CJE=750.714947333303P FC=500.000000591082M IKF=188.42211535203M
+ IKR=327.12185106126 IS=32.446322794815F ISC=99.999957108478P
+ ISE=1.005936551408P ITF=970.587903968311F MJC=397.017213039397M
+ MJE=511.923372766915M NC=2.000000003587 NE=1.242575861124
+ NF=849.771187453965M RC=77.30919622468M RE=167.336137584082M
+ TF=2.863916554465N TR=846.146257197563U VAF=100 VJC=700.000000003284M
+ VJE=999.999999947759M VTF=10.281210139556 XTF=419.951324004194M)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Switching transistor
.MODEL 2N3648 NPN (BF=118.583 BR=2.76778m CJC=18.3219p CJE=11.313p IKF=173.483m
+ IKR=77.8198 IS=10.0268f ISC=98.0321p ISE=989.335f ITF=10m MJC=558.067m
+ MJE=642.888m NE=1.52169 NF=1.01873 RE=1.33793 TF=1n TR=8.20103u VAF=100
+ VJC=700m VJE=700m VTF=10 XTF=500m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General Purpose transistor
.MODEL 2N3700 NPN (BF=230.82 BR=5 CJC=54.9657p CJE=84.8478p IKF=541.132m
+ IKR=994.106 IS=10.0235f ISC=.030062f ISE=10.1214f ITF=9.85324m MJC=558.067m
+ MJE=642.888m NE=1.75058 NF=1.01959 RE=2 TF=1.17383n TR=10n VAF=100 VJC=700m
+ VJE=700m VTF=10 XTF=500.001m)
*** From file C:\MC12\library\CS.LIB
.MODEL 2N3704 NPN (BF=240 BR=4.00 CJC=12.4P CJE=24.9P EG=1.12 IKF=0.293
+ IKR=0.600 IS=2.20F ISE=2.73P MJC=0.300 MJE=0.500 NE=2.00 NF=1.00 NR=1.00
+ RB=0.777 RC=77.7M RE=0.194 TF=371P TR=64.0N VAF=114 VAR=24.0 VJC=0.300
+ VJE=1.10 XTB=1.5)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Ampilifier transistors
.MODEL BC337_16 NPN (BF=200 BR=2.69676 CJC=11.5113p CJE=34.193p IKF=1
+ IKR=522.535 IS=10.0039f ISC=4.27321f ISE=1.0108p ITF=9.88943m MJC=391.345m
+ MJE=370.304m NE=1.75714 NF=988.174m RE=418.399m TF=500.788p TR=10n VAF=100
+ VJC=700m VJE=752.182m VTF=10 XTF=500.013m)
*** From file C:\MC12\library\PH_BJT.LIB
```

```
.MODEL BF469 NPN (BF=122 BR=6.235 CJC=5.045E-12 CJE=1.742E-11 FC=0.8555
+ IKF=0.01029 IKR=0.02746 IRB=1E-06 IS=7.974E-15 ISC=4.33E-12 ISE=2.266E-16
+ ITF=0.1495 MJC=0.1947 MJE=0.3092 MJS=0.333 NC=1.397 NE=1.18 NF=0.993 NR=0.999
+ RB=1 RBM=0.5 RC=0.439 RE=0.3814 TF=7.073E-10 TR=1E-08 VAF=25.51 VAR=19.43
+ VJC=0.197 VJE=0.4581 VJS=0.75 VTF=6.144 XCJC=0.1041 XTF=289.5)
*** From file C:\MC12\library\EUROPE.LBR
*** NPN AF transistor
.MODEL BC108B NPN (BF=242.854111 BR=161.449686m CJC=6.117149p CJE=11.82627p
+ IKF=10K IKR=21.026285 IS=10.00035f ISC=6.657168f ISE=1.009243p ITF=9.95368m
+ MJC=361.358643m MJE=673.545063m NE=1.809951 NF=912.846446m RE=2
+ TF=395.633026p TR=10n VAF=62.366673 VJC=949.695349m VJE=1 VTF=10
+ XTF=500.000119m)
*** From file C:\MC12\library\EUROPE.LBR
*** NPN AF transistor
.MODEL BC107A NPN (BF=201.511795 BR=165.146813m CJC=6.117149p CJE=11.82627p
+ IKF=10K IKR=84.490936 IS=10.00035f ISC=4.707919f ISE=1.02365p ITF=9.95368m
+ MJC=361.358643m MJE=673.545063m NE=1.665544 NF=912.846446m RE=2
+ TF=395.633026p TR=10n VAF=106.811111 VJC=949.695349m VJE=1 VTF=10
+ XTF=500.000119m)
*** From file C:\MC12\library\INFINEON.LIB
.MODEL BCP55 NPN (AF=1.00E+00 BF=1.29E+02 BR=2.92E+00 CJC=4.85E-11 CJE=1.17E-10
+ CJS=0.00E+00 EG=1.11E+00 FC=5.00E-01 IKF=9.06E-01 IKR=1.00E+00 IRB=2.38E-02
+ IS=3.06E-15 ISC=4.08E-14 ISE=1.62E-16 ITF=5.64E-01 KF=0.00E+00 MJC=5.09E-01
+ MJE=4.22E-01 MJS=3.30E-01 NC=1.00E+00 NE=1.00E+00 NF=8.55E-01 NR=9.10E-01
+ PTF=0.00E+00 RB=1.65E+01 RBM=1.73E-02 RC=3.11E-01 RE=1.26E-02 TF=1.42E-09
+ TR=0.00E+00 VAF=7.24E+02 VAR=5.46E+01 VJC=3.00E-01 VJE=3.00E-01 VJS=7.50E-01
+ VTF=9.99E+05 XCJC=1.00E+00 XTB=0.00E+00 XTF=7.75E-01 XTI=3.00E+00)
*** From file C:\MC12\library\INFINEON.LIB
.MODEL BCP54 NPN (AF=1.00E+00 BF=1.29E+02 BR=2.92E+00 CJC=4.85E-11 CJE=1.17E-10
+ CJS=0.00E+00 EG=1.11E+00 FC=5.00E-01 IKF=9.06E-01 IKR=1.00E+00 IRB=2.38E-02
+ IS=3.06E-15 ISC=4.08E-14 ISE=1.62E-16 ITF=5.64E-01 KF=0.00E+00 MJC=5.09E-01
+ MJE=4.22E-01 MJS=3.30E-01 NC=1.00E+00 NE=1.00E+00 NF=8.55E-01 NR=9.10E-01
+ PTF=0.00E+00 RB=1.65E+01 RBM=1.73E-02 RC=3.11E-01 RE=1.26E-02 TF=1.42E-09
+ TR=0.00E+00 VAF=7.24E+02 VAR=5.46E+01 VJC=3.00E-01 VJE=3.00E-01 VJS=7.50E-01
+ VTF=9.99E+05 XCJC=1.00E+00 XTB=0.00E+00 XTF=7.75E-01 XTI=3.00E+00)
*** From file C:\MC12\library\EUROPE.LBR
*** NPN General Purpose Transistor
.MODEL BCW32 NPN (BF=382.973267 BR=747.519016m CJC=7.151779p CJE=2p
+ IKF=131.536111m IKR=10.000534m IS=9.999513f ISC=1.689241f ISE=98.889202p
+ ITF=9.907999m MJC=449.389994m MJE=500m NE=2.809266 NF=999.655008m
+ RC=238.111854m RE=1.654509 TF=431.503444p TR=10n VAF=100 VJC=699.999988m
+ VTF=10 XTF=500.017583m)
*** From file C:\MC12\library\INFINEON.LIB
.MODEL BCX55 NPN (AF=1.00E+00 BF=1.29E+02 BR=2.92E+00 CJC=4.85E-11 CJE=1.17E-10
+ CJS=0.00E+00 EG=1.11E+00 FC=5.00E-01 IKF=9.06E-01 IKR=1.00E+00 IRB=2.38E-02
+ IS=3.06E-15 ISC=4.08E-14 ISE=1.62E-16 ITF=5.64E-01 KF=0.00E+00 MJC=5.09E-01
```

```
+ MJE=4.22E-01 MJS=3.30E-01 NC=1.00E+00 NE=1.00E+00 NF=8.55E-01 NR=9.10E-01
+ PTF=0.00E+00 RB=1.65E+01 RBM=1.73E-02 RC=3.11E-01 RE=1.26E-02 TF=1.42E-09
+ TR=0.00E+00 VAF=7.24E+02 VAR=5.46E+01 VJC=3.00E-01 VJE=3.00E-01 VJS=7.50E-01
+ VTF=9.99E+05 XCJC=1.00E+00 XTB=0.00E+00 XTF=7.75E-01 XTI=3.00E+00)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistor
.MODEL 2N3903 NPN (BF=174.935 BR=569.651m CJC=3.66467p CJE=4.42095p
+ IKF=25.5645m IKR=804.65 IS=10.0184f ISC=100p ISE=1.0108p ITF=9.9491m MJC=300m
+ MJE=423.145m NE=1.63812 NF=1.01772 RE=1.47525 TF=576.506p TR=525.192n
+ VAF=101.811 VJC=700.055m VJE=1 VTF=10 XTF=499.996m)
*** From file C:\MC12\library\MPBJT.LIB
.MODEL MJD340 NPN (BF=153.327436320961 BR=9.06953M CJC=5P CJE=2P
+ IKF=83.932164258063M IKR=409.751893665853 IS=9.967484649613F
+ ISC=1.465299989607P ISE=98.5957P ITF=10M MJC=500M MJE=500M NC=2.000000004741
+ NE=1.874026552459 NF=925.636810701417M RC=1.999999999885 RE=189.96640293538M
+ TF=1N TR=10N VAF=100 VTF=10 XTF=500M)
*** From file C:\MC12\library\ON_SEMI.LIB
.MODEL Q2N3904 NPN (BF=206.302 BR=20.6302 CJC=3.76961E-12 CJE=4.64214E-12
+ EG=1.05 FC=0.512134 IKF=0.0272221 IKR=0.272221 IRB=50.3624 IS=1.26532E-10
+ ISC=2.30771E-09 ISE=2.30771E-09 ITF=0.0105823 MJC=0.238109 MJE=0.256227
+ MJS=0.5 NC=1.9876 NE=3.31052 NF=1.5 NR=2.89609 RB=5.8376 RBM=0.634251
+ RC=2.65711 RE=0.0001 TF=4.19578E-10 TR=6.82023E-08 VAF=1000 VAR=9.39809
+ VJC=0.4 VJE=0.4 VJS=0.75 VTF=8.75418 XCJC=0.8 XTB=0.1 XTF=0.906167 XTI=1)
*** From file C:\MC12\library\ON_SEMI.LIB
.MODEL Q2N2102 NPN (BF=79.3546 BR=3.76239 CJC=1.3035E-11 CJE=1E-11 EG=1.05
+ FC=0.5 IKF=0.640083 IKR=2.76346 IRB=0.1 IS=1.1791E-10 ISC=3.24999E-13
+ ISE=7.91563E-12 ITF=0.01 MJC=0.23 MJE=0.33 MJS=0.5 NC=3.96875 NE=3.31476
+ NF=1.42901 NR=1.5 RB=0.1 RBM=0.1 RC=0.38569 RE=0.00431604 TF=1E-09 TR=1E-07
+ VAF=30.134 VAR=3.69384 VJC=0.62509 VJE=0.75 VJS=0.75 VTF=10 XCJC=0.9 XTB=0.1
+ XTF=1 XTI=1)
*** From file C:\MC12\library\ON_SEMI.LIB
.MODEL QBC547B NPN (BF=1343.59 BR=62.79 CJC=4.04665E-12 CJE=7.34106E-12 EG=1.05
+ FC=0.8 IKF=0.427163 IKR=4.27163 IRB=0.1 IS=7.443E-11 ISC=2.4623E-10
+ ISE=2.4623E-10 ITF=0.487193 MJC=0.343664 MJE=0.33309 MJS=0.5 NC=1.9119
+ NE=2.73946 NF=1.42606 NR=1.5 RB=0.1 RBM=0.1 RC=3.01102 RE=0.579065
+ TF=5.7202E-10 TR=1E-07 VAF=80.4901 VAR=1.0092 VJC=0.95 VJE=0.586136 VJS=0.75
+ VTF=26.03 XCJC=0.799994 XTB=0.1 XTF=4.45797 XTI=2.25359)
*** From file C:\MC12\library\ON_SEMI.LIB
.MODEL QBC846BLT1G NPN (BF=313.939 BR=31.3939 CJC=1.97395E-12 CJE=7.31938E-12
+ EG=1.206 FC=0.8 IKF=0.0670247 IKR=0.670247 IRB=0.1 IS=6.21868E-15
+ ISC=5.02001E-14 ISE=6.72945E-10 ITF=12.3428 MJC=0.33914 MJE=0.236218 MJS=0.5
+ NC=1.10677 NE=4 NF=0.978615 NR=1.03954 RB=45.553 RBM=0.1 RC=0.909048
+ RE=0.18181 TF=6.54085E-10 TR=1E-07 VAF=808.652 VAR=311.824 VJC=0.95
+ VJE=0.479294 VJS=0.75 VTF=8791.04 XTB=1.26632 XTF=1000 XTI=1.16217)
*** From file C:\MC12\library\ON_SEMI.LIB
.MODEL QBD139 NPN (BF=222.664 BR=1.35467 CJC=1E-11 CJE=1E-11 EG=1.05 FC=0.5
```

```
+ IKF=0.166126 IKR=1.66126 IRB=0.1 IS=1E-09 ISC=5.02557E-09 ISE=5.03418E-09
+ ITF=0.01 MJC=0.33 MJE=0.33 MJS=0.5 NC=3.10227 NE=1.45313 NF=0.85 NR=1.33751
+ RB=26.9143 RBM=0.1 RC=1.04109 RE=0.000472454 TF=1E-09 TR=1E-07 VAF=36.4079
+ VAR=142.931 VJC=0.75 VJE=0.75 VJS=0.75 VTF=10 XCJC=0.9 XTB=0.727762 XTF=1
+ XTI=1.04311)
*** From file C:\MC12\library\ON_SEMI.LIB
.MODEL QBD179 NPN (BF=87.3643 BR=3.54279 CJC=4.44061E-10 CJE=5.51549E-08
+ EG=1.05012 FC=0.585759 IKF=5.92007 IKR=8.04318 IRB=0.1 IS=2.17735E-10
+ ISC=2.88133E-13 ISE=8.67187E-12 ITF=0.999983 MJC=0.410398 MJE=0.457535
+ MJS=0.5 NC=3.98064 NE=3.34988 NF=1.21238 NR=1.26704 RB=15.3279 RBM=0.1
+ RC=0.254026 RE=0.000912821 TF=1E-08 TR=1E-07 VAF=10 VAR=1.60537 VJC=0.400133
+ VJE=0.591953 VJS=0.75 VTF=0.995733 XCJC=0.803125 XTB=0.1 XTF=1.35722 XTI=1)
*** From file C:\MC12\library\EUROPE.LBR
*** NPN switching transistor
.MODEL SMBT2222 NPN (BF=119.260674 BR=635.042429m CJC=36.643716p CJE=55.85404p
+ IKF=476.359129m IKR=328.566284 IS=9.975837f ISC=99.999946p ISE=943.656178f
+ ITF=15.831411m MJC=558.065891m MJE=595.488667m NE=1.619519 NF=975.424469m
+ RE=636.37805m TF=304.506614p TR=603.016474n VAF=81.609085 VJC=699.999988m
+ VJE=700.000048m VTF=11.027942 XTF=3.711595)
*** From file C:\MC12\library\EUROPE.LBR
*** NPN switching transistor
.MODEL SMBT2222A NPN (BF=119.260674 BR=635.042429m CJC=36.643716p CJE=55.85404p
+ IKF=476.359129m IKR=328.566284 IS=9.975837f ISC=99.999946p ISE=943.656178f
+ ITF=15.831411m MJC=558.065891m MJE=595.488667m NE=1.619519 NF=975.424469m
+ RE=636.37805m TF=304.506614p TR=603.016474n VAF=81.609085 VJC=699.999988m
+ VJE=700.000048m VTF=11.027942 XTF=3.711595)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Amplifer transistors
.MODEL BC548C NPN (BF=630.776 BR=2.58734 CJC=6.40421p CJE=19.7395p IKF=104.728m
+ IKR=954.174 IS=7.88857f ISC=4.56856p ISE=2.59643f ITF=9.88981m MJC=316.254m
+ MJE=312.92m NE=1.26993 NF=968.124m RE=1.23191 TF=374.789p TR=10n VAF=100
+ VJC=700m VJE=770.586m VTF=10 XTF=499.98m)
*** From file C:\MC12\library\MPBJT.LIB
.MODEL BD135_16 NPN (BF=199.996209903524 BR=99.671345772217M CJC=5P CJE=2P
+ IKF=559.818760296133M IKR=999.999675660315M IS=9.999956070726F
+ ISC=404.194992780472F ISE=972.249942004551F ITF=10M MJC=500M MJE=500M
+ NC=2.000000001175 NE=1.562677837831 NF=1.001625491959 RC=309.205194321893M
+ RE=365.688938169078M TF=1N TR=10N VAF=100 VTF=10 XTF=500M)
*** From file C:\MC12\library\MPBJT.LIB
.MODEL BD135_6 NPN (BF=199.996209903524 BR=99.671345772217M CJC=5P CJE=2P
+ IKF=559.818760296133M IKR=999.999675660315M IS=9.999956070726F
+ ISC=404.194992780472F ISE=972.249942004551F ITF=10M MJC=500M MJE=500M
+ NC=2.000000001175 NE=1.562677837831 NF=1.001625491959 RC=309.205194321893M
+ RE=365.688938169078M TF=1N TR=10N VAF=100 VTF=10 XTF=500M)
*** From file C:\MC12\library\ON_SEMI.LIB
.MODEL QPZT2222AT1 NPN (BF=1256.22 BR=38.0369 CJC=1.24128E-11 CJE=2.53476E-11
```

```
+ EG=1.206 FC=0.53103 IKF=0.327148 IKR=0.0630953 IRB=4.19636 IS=3.17132E-13
+ ISC=1.00431E-16 ISE=7.42524E-12 ITF=0.322863 MJC=0.266348 MJE=0.301384
+ MJS=0.5 NC=4 NE=1.73924 NF=1.02244 NR=1.01607 RB=1.96428 RBM=0.0103279
+ RC=0.180572 RE=1E-05 TF=3.86575E-10 TR=2.55854E-10 VAF=84.3948 VAR=0.995915
+ VJC=0.142948 VJE=0.415008 VJS=0.75 VTF=36.1583 XCJC=0.899999 XTB=3.42142
+ XTF=1.81864 XTI=0.0102863)
*** From file C:\MC12\library\ON_SEMI.LIB
.MODEL QBD135 NPN (BF=222.664 BR=1.35467 CJC=1E-11 CJE=1E-11 EG=1.05 FC=0.5
+ IKF=0.166126 IKR=1.66126 IRB=0.1 IS=1E-09 ISC=5.02557E-09 ISE=5.03418E-09
+ ITF=0.01 MJC=0.33 MJE=0.33 MJS=0.5 NC=3.10227 NE=1.45313 NF=0.85 NR=1.33751
+ RB=26.9143 RBM=0.1 RC=1.04109 RE=0.000472454 TF=1E-09 TR=1E-07 VAF=36.4079
+ VAR=142.931 VJC=0.75 VJE=0.75 VJS=0.75 VTF=10 XCJC=0.9 XTB=0.727762 XTF=1
+ XTI=1.04311)
*** From file C:\MC12\library\ON_SEMI.LIB
.MODEL QBCP56 NPN (BF=271.4 BR=2.34385 CJC=1.45328E-10 CJE=2.33033E-11 EG=1.05
+ FC=0.8 IKF=0.122308 IKR=0.100547 IRB=0.1 IS=3.975E-13 ISC=5.686E-13
+ ISE=1.02548E-12 ITF=5.74918 MJC=0.243664 MJE=0.393982 MJS=0.5 NC=1.35918
+ NE=1.5769 NF=1.1069 NR=1.19783 RB=0.1 RBM=0.01 RC=0.219302 RE=0.0438603
+ TF=4.137E-10 TR=1E-07 VAF=10 VAR=100 VJC=0.445621 VJE=0.4 VJS=0.75
+ VTF=92622.7 XCJC=0.905221 XTB=1.30319 XTF=1000 XTI=1)
*** From file C:\MC12\library\EUROPE.LBR
*** NPN switching transistor
.MODEL PZT2222 NPN (BF=119.260674 BR=635.042429m CJC=36.643716p CJE=55.85404p
+ IKF=476.359129m IKR=328.566284 IS=9.975837f ISC=99.999946p ISE=943.656178f
+ ITF=15.831411m MJC=558.065891m MJE=595.488667m NE=1.619519 NF=975.424469m
+ RE=636.37805m TF=304.506614p TR=603.016474n VAF=81.609085 VJC=699.999988m
+ VJE=700.000048m VTF=11.027942 XTF=3.711595)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN High voltage transistors
.MODEL MPSA42 NPN (BF=199.994 BR=1.08729 CJC=12.3409p CJE=49.243p IKF=10K
+ IKR=300.7m IS=25.1183f ISC=.0136691f ISE=991.903f ITF=9.96656m MJC=486.179m
+ MJE=381.836m NC=2.00003 NE=1.49482 NF=998.408m RC=1.92096 RE=1.86192
+ TF=2.77598n TR=10n VAF=100 VJC=738.958m VJE=751.471m VTF=10 XTF=499.995m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN 45V 200mA
.MODEL MPSA18 NPN (BF=1.76188K BR=664.793m CJC=5.07301p CJE=8.599p FC=500.001m
+ IKF=328.299 IKR=10m IS=10.027f ISC=.00232848f ISE=.184053f ITF=12.2563m
+ MJC=428.416m MJE=485.323m NE=1.07015 NF=915.364m RC=673.622m RE=413.866m
+ TF=317.143p TR=10n VAF=100 VJC=725.529m VJE=750.089m VTF=10 XTF=500.108m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN 350V 300mA
.MODEL MPSA45 NPN (BF=151.433 BR=3.89865m CJC=15.9565p CJE=114.101p
+ IKF=138.279m IKR=8.5962 IS=17.8901f ISC=99.9993p ISE=827.891f ITF=10m
+ MJC=376.477m MJE=400.447m NE=1.39518 NF=893.074m RC=2 RE=520.154m TF=1n
+ TR=1.7344m VAF=100 VJC=883.655m VJE=780.13m VTF=10 XTF=500m)
*** From file C:\MC12\library\MSBJT.LBR
```

```
*** NPN High voltage transistors
.MODEL MPSA43 NPN (BF=199.994 BR=1.08729 CJC=12.3409p CJE=49.243p IKF=10K
+ IKR=300.7m IS=25.1183f ISC=.0136691f ISE=991.903f ITF=9.96656m MJC=486.179m
+ MJE=381.836m NC=2.00003 NE=1.49482 NF=998.408m RC=1.92096 RE=1.86192
+ TF=2.77598n TR=10n VAF=100 VJC=738.958m VJE=751.471m VTF=10 XTF=499.995m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN 400V 300mA
.MODEL MPSA44 NPN (BF=151.433 BR=3.89865m CJC=15.9565p CJE=114.101p
+ IKF=138.279m IKR=8.5962 IS=17.8901f ISC=99.9993p ISE=827.891f ITF=10m
+ MJC=376.477m MJE=400.447m NE=1.39518 NF=893.074m RC=2 RE=520.154m TF=1n
+ TR=1.7344m VAF=100 VJC=883.655m VJE=780.13m VTF=10 XTF=500m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN 80V 500mA
.MODEL MPSA06 NPN (BF=826.794 BR=247.354m CJC=17.7143p CJE=54.5263p
+ IKF=75.5761m IKR=998.715 IS=10.0605f ISC=100p ISE=1.03564p ITF=10.3807m
+ MJC=308.249m MJE=382.441m NE=1.43501 NF=894.567m RE=180.651m TF=491.726p
+ TR=6.25476u VAF=100 VJC=700m VJE=757.195m VTF=10 XTF=500.057m)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN General purpose transistors
.MODEL MPS3904 NPN (BF=170.316 BR=4.32097 CJC=4.78939p CJE=7.44303p FC=500.005m
+ IKF=381.985m IKR=10m IS=10.0046f ISC=.00332557f ISE=841.916f ITF=10.0113m
+ MJC=346.53m MJE=336.256m NE=1.83906 NF=1.00722 RC=472.285m RE=1.71948
+ TF=713.071p TR=665.626n VAF=100 VJC=700m VJE=749.172m VTF=10 XTF=499.999m)
*** From file C:\MC12\library\ROHM_TRANSISTOR.LIB
.MODEL MMST3904 NPN (BF=418.50 BR=1.4445 CJC=3.1745E-12 CJE=6.3252E-12
+ IKF=.11777 IKR=14.562 IS=7.8000E-15 ISC=71.780E-12 ISE=107.33E-15 ITF=10.142
+ MJC=.19463 MJE=.35786 NC=1.5919 NE=1.4561 NK=.73861 RB=7.1334 RC=.86215
+ TF=281.52E-12 TR=121.92E-9 VAF=210 VAR=16 VJC=.77077 VJE=.62919 VTF=945.94
+ XTB=1.5000 XTF=1.6571E3)
*** From file C:\MC12\library\DIODESINC_BJT.LIB
.MODEL MMBTA05 NPN (BF=547 BR=4.00 CJC=18.9P CJE=58.7P EG=1.12 IKF=0.146
+ IKR=0.360 IS=51.3F ISE=11.1P MJC=0.300 MJE=0.500 NE=2.00 NF=1.00 NR=1.00
+ RB=0.892 RC=89.2M RE=0.223 TF=631P TR=110N VAF=139 VAR=16.0 VJC=0.300
+ VJE=1.10 XTB=1.5)
*** From file C:\MC12\library\DIODESINC_BJT.LIB
.MODEL MMBT5551 NPN (BF=110 BR=4.5 CJC=6.1E-12 CJE=57E-12 GAMMA=2.2E-7
+ IS=6.5E-15 ISC=3E-12 ISE=1.0E-14 MJC=0.31 MJE=0.35 NC=1.35 QUASIMOD=1 RB=0.26
+ RC=0.5 RCO=170 RE=0.23 TF=0.2E-9 TR=1.5E-6 VAF=288 VAR=70 VJC=0.4 VJE=0.8
+ VO=35 XTB=1.4)
*** From file C:\MC12\library\DIODESINC_BJT.LIB
.MODEL MMBT4401 NPN (BF=410 BR=4.00 CJC=15.4P CJE=36.2P EG=1.12 IKF=0.364
+ IKR=0.900 IS=60.9F ISE=25.5P MJC=0.300 MJE=0.500 NE=2.00 NF=1.00 NR=1.00
+ RB=2.85 RC=0.285 RE=0.713 TF=717P TR=121N VAF=114 VAR=24.0 VJC=0.300 VJE=1.10
+ XTB=1.5)
*** From file C:\MC12\library\PH_BJT.LIB
.MODEL MMBT3904 NPN (BF=160.1 BR=5.944 CJC=4.949E-12 CJE=5.631E-12 FC=0.5582
```

```
+ IKF=0.12 IKR=0.06 IRB=1E-06 IS=4.639E-15 ISC=3.257E-12 ISE=2.091E-14
+ ITF=0.2723 MJC=0.1928 MJE=0.3385 MJS=0.333 NC=1.394 NE=1.6 NF=0.9995 NR=1.001
+ RB=1 RBM=1 RC=1.755 RE=0.3614 TF=3.001E-10 TR=9.4E-8 VAF=98.69 VAR=19.29
+ VJC=0.5969 VJE=0.7002 VJS=0.75 VTF=1.461 XCJC=0.864 XTF=27)
*** From file C:\MC12\library\MPBJT.LIB
.MODEL MJE13003 NPN (BF=54.690010619121 BR=175.039727193028M
+ CJC=65.324721244812P CJE=470.312845620747P FC=500.000000689595M
+ IKF=396.026322424384M IKR=2.94664313131 IS=14.742464284553F
+ ISC=99.999425981847P ISE=733.562805367392F ITF=10.557211889412M
+ MJC=347.310298235196M MJE=353.758051288424M NC=2.000000002364
+ NE=1.275793682845 NF=926.558277879762M RE=106.776587684428M
+ TF=31.526115542948N TR=47.101363642279U VAF=100 VJC=700.000000064161M
+ VJE=752.294720158486M VTF=9.999999749778 XTF=499.995317453514M)
*** From file C:\MC12\library\MPBJT.LIB
.MODEL MJE340 NPN (BF=150.104127917994 BR=3.31414M CJC=5P CJE=2P
+ IKF=86.010606635967M IKR=41.347096317171 IS=9.960903630403F
+ ISC=99.306674299094P ISE=100P ITF=10M MJC=500M MJE=500M NC=2.000000006336
+ NE=1.780582939056 NF=878.116046897223M RC=1.01430252556 RE=271.465436359113M
+ TF=1N TR=10N VAF=100 VTF=10 XTF=500M)
*** From file C:\MC12\library\ON_SEMI.LIB
.MODEL KSC2881 NPN (BF=89.8 BR=18.44 CJC=2.281471E-10 CJE=2.279881E-10
+ CJS=1E-12 EG=1.17 FC=0.5 IKF=2.34446 IKR=0.912011 IRB=6.91831E-7
+ IS=1.58489E-13 ISC=1.25893E-10 ISE=1.25893E-10 MJC=0.3426036 MJE=0.3455809
+ MJS=0.33 NC=1.5 NE=2 RB=190.5 RBM=1.164 RC=0.02 RE=0.07 TF=1.33E-9 TR=1E-8
+ VAF=40.75 VAR=12.27 VJC=0.6745879 VJE=0.6912784 VJS=0.8 XTB=1.5)
*** From file C:\MC12\library\ON_SEMI.LIB
.MODEL KSC1815 NPN (BF=127.6 BR=4.595 CJC=6.29422E-12 CJE=2.041E-11 EG=1.1971
+ FC=0.5 IKF=1.13 IKR=0.793 IRB=5.62341E-6 IS=2.04174E-14 ISC=1.31826E-13
+ ISE=1.20226E-14 MJC=0.247613 MJE=0.315545 NC=1.5 NK=0.853 RB=34 RBM=17.083
+ RC=7.7 RE=0.38 TF=1.99E-9 VAF=121.25 VAR=24.03 VJC=0.410107 VJE=0.692258
+ XCJC=0.45 XTB=1.6738)
*** From file C:\MC12\library\ON_SEMI.LIB
.MODEL KSC1845 NPN (BF=620.7 BR=0.365 CJC=5.625739E-12 CJE=1.10447E-11
+ EG=1.1809 FC=0.5 IKF=0.20596 IKR=0.0190546 IRB=1.258925E-6 IS=5.075431E-13
+ ISC=1.8378E-12 ISE=1.68107E-12 ITF=0.0044 MJC=0.3059045 MJE=0.1619943 NC=1.5
+ NE=2.0 RB=107 RBM=0.292 RC=0.28 RE=0.15 TF=1.108E-9 TR=1.0E-8 VAF=82.803
+ VAR=100 VJC=0.45 VJE=0.7300286 VTF=4.0 XTB=1.7281 XTF=2.250)
*** From file C:\MC12\library\PH_BJT.LIB
.MODEL BFV420 NPN (BF=335.9 BR=20.05 CJC=3.38E-12 CJE=1.611E-11 FC=0.909
+ IKF=0.195 IKR=0.03 IRB=0.0001391 IS=2E-14 ISC=1.063E-12 ISE=8.61E-13
+ ITF=0.1806 MJC=0.2154 MJE=0.3749 MJS=0.333 NC=1.35 NE=1.751 NF=0.9861
+ NR=0.989 RB=36.6 RBM=7.069 RC=0.45 RE=0.388 TF=6.79E-10 TR=7.14E-08 VAF=303.4
+ VAR=23 VJC=0.05 VJE=0.773 VJS=0.75 VTF=2.217 XCJC=0.553 XTF=19.83)
*** From file C:\MC12\library\PH_BJT.LIB
.MODEL BFV469 NPN (BF=335.9 BR=20.05 CJC=3.38E-12 CJE=1.611E-11 FC=0.909
+ IKF=0.195 IKR=0.03 IRB=0.0001391 IS=2E-14 ISC=1.063E-12 ISE=8.61E-13
```

```
+ ITF=0.1806 MJC=0.2154 MJE=0.3749 MJS=0.333 NC=1.35 NE=1.751 NF=0.9861
+ NR=0.989 RB=36.6 RBM=7.069 RC=0.45 RE=0.388 TF=6.79E-10 TR=7.14E-08 VAF=303.4
+ VAR=23 VJC=0.05 VJE=0.773 VJS=0.75 VTF=2.217 XCJC=0.553 XTF=19.83)
*** From file C:\MC12\library\INFINEON.LIB
.MODEL BFP22 NPN (AF=1.00E+00 BF=7.04E+01 BR=1.76E+01 CJC=1.56E-11 CJE=1.31E-10
+ CJS=0.00E+00 EG=1.11E+00 FC=5.00E-01 IKF=1.00E+01 IKR=1.00E+00 IRB=1.30E-03
+ IS=1.59E-13 ISC=9.06E-11 ISE=3.62E-16 ITF=1.33E+00 KF=0.00E+00 MJC=5.80E-01
+ MJE=4.02E-01 MJS=3.30E-01 NC=1.47E+00 NE=1.21E+00 NF=1.03E+00 NR=1.11E+00
+ PTF=0.00E+00 RB=3.23E+01 RBM=7.75E-02 RC=4.11E-01 RE=4.19E-01 TF=1.73E-09
+ TR=0.00E+00 VAF=4.51E+01 VAR=9.11E+01 VJC=4.64E-01 VJE=3.00E-01 VJS=7.50E-01
+ VTF=9.99E+05 XCJC=1.00E+00 XTB=0.00E+00 XTF=1.00E+02 XTI=3.00E+00)
*** From file C:\MC12\library\INFINEON.LIB
.MODEL BFN24 NPN (AF=1.00E+00 BF=7.04E+01 BR=1.76E+01 CJC=1.56E-11 CJE=1.31E-10
+ CJS=0.00E+00 EG=1.11E+00 FC=5.00E-01 IKF=1.00E+01 IKR=1.00E+00 IRB=1.30E-03
+ IS=1.59E-13 ISC=9.06E-11 ISE=3.62E-16 ITF=1.33E+00 KF=0.00E+00 MJC=5.80E-01
+ MJE=4.02E-01 MJS=3.30E-01 NC=1.47E+00 NE=1.21E+00 NF=1.03E+00 NR=1.11E+00
+ PTF=0.00E+00 RB=3.23E+01 RBM=7.75E-02 RC=4.11E-01 RE=4.19E-01 TF=1.73E-09
+ TR=0.00E+00 VAF=4.51E+01 VAR=9.11E+01 VJC=4.64E-01 VJE=3.00E-01 VJS=7.50E-01
+ VTF=9.99E+05 XCJC=1.00E+00 XTB=0.00E+00 XTF=1.00E+02 XTI=3.00E+00)
*** From file C:\MC12\library\INFINEON.LIB
.MODEL BFN16 NPN (AF=1.00E+00 BF=7.04E+01 BR=1.76E+01 CJC=1.56E-11 CJE=1.31E-10
+ CJS=0.00E+00 EG=1.11E+00 FC=5.00E-01 IKF=1.00E+01 IKR=1.00E+00 IRB=1.30E-03
+ IS=1.59E-13 ISC=9.06E-11 ISE=3.62E-16 ITF=1.33E+00 KF=0.00E+00 MJC=5.80E-01
+ MJE=4.02E-01 MJS=3.30E-01 NC=1.47E+00 NE=1.21E+00 NF=1.03E+00 NR=1.11E+00
+ PTF=0.00E+00 RB=3.23E+01 RBM=7.75E-02 RC=4.11E-01 RE=4.19E-01 TF=1.73E-09
+ TR=0.00E+00 VAF=4.51E+01 VAR=9.11E+01 VJC=4.64E-01 VJE=3.00E-01 VJS=7.50E-01
+ VTF=9.99E+05 XCJC=1.00E+00 XTB=0.00E+00 XTF=1.00E+02 XTI=3.00E+00)
*** From file C:\MC12\library\PH_BJT.LIB
.MODEL BF869 NPN (BF=122 BR=6.235 CJC=5.045E-12 CJE=1.742E-11 FC=0.8555
+ IKF=0.01029 IKR=0.02746 IRB=1E-06 IS=7.974E-15 ISC=4.33E-12 ISE=2.266E-16
+ ITF=0.1495 MJC=0.1947 MJE=0.3092 MJS=0.333 NC=1.397 NE=1.18 NF=0.993 NR=0.999
+ RB=1 RBM=0.5 RC=0.439 RE=0.3814 TF=7.073E-10 TR=1E-08 VAF=25.51 VAR=19.43
+ VJC=0.197 VJE=0.4581 VJS=0.75 VTF=6.144 XCJC=0.1041 XTF=289.5)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN High voltage transistors
.MODEL BF420 NPN (BF=199.994 BR=1.08729 CJC=12.3409p CJE=49.243p IKF=10K
+ IKR=300.7m IS=25.1183f ISC=.0136691f ISE=991.903f ITF=9.90906m MJC=486.179m
+ MJE=381.836m NC=2.00003 NE=1.49482 NF=998.408m RC=1.92096 RE=1.86192
+ TF=2.14233n TR=10n VAF=100 VJC=738.958m VJE=751.471m VTF=10 XTF=499.986m)

.MODEL AC127 NPN IS=1f IB=400u ISC=1u IKF=20m ITF=0.4
+NC=3 NE=2.5 BF=70 BR=5 RC=10 RB=50 RE=1 CJC=50p CJE=10p
+TR=8u TF=400n FC=0.5 EG=0.67 VAF=60 VJC=0.28 VJE=0.28 VTF=4
+MJC=0.4 MJE=0.4 XTB=2.0 XTF=6 XTI=3.5
.END
```

```
.MODEL AC128 PNP (BF=70 BR=5 CJC=50p CJE=10p EG=0.67 FC=0.5 IKF=20m IS=1f
+ ISC=1u ITF=0.4 MJC=0.4 MJE=0.4 NC=3 NE=2.5 RB=50 RC=10 RE=1 TF=1u TR=20u
+ VAF=60 VJC=0.28 VJE=0.28 VTF=4 XTB=2.0 XTF=6 XTI=3.5)
.END

.MODEL MP14 PNP (BF=140 BR=4 CJC=90p CJE=30p EG=0.72 IKF=50m IRB=0.1m IS=3u
+ ISC=0.6u ISE=.3u MJC=0.5 MJE=0.5 NC=1.28 NE=1.28 RB=150 RBM=50 TF=0.1u TR=1.u
+ VAF=48)
.MODEL MP10 NPN (BF=140 BR=4 CJC=90p CJE=30p EG=0.72 IKF=50m IRB=0.1m IS=3u
+ ISC=.6u ISE=.3u MJC=0.5 MJE=0.5 NC=1.28 NE=1.28 RB=150 RBM=50 TF=0.1u TR=1.u
+ VAF=48)
.MODEL MP25A PNP (BF=140 BR=3 CJC=90p CJE=30p EG=0.72 IKF=40m IRB=0.1m IS=3u
+ ISC=.6u ISE=.3u MJC=0.5 MJE=0.5 NC=1.28 NE=1.28 RB=120 RBM=40 TF=0.4u TR=4u
+ VAF=30)
.MODEL GT308B PNP (BF=240 BR=.3 CJC=15p CJE=20p EG=0.72 IKF=45m IRB=1m IS=100n
+ ISC=.7u ISE=25n MJC=0.5 MJE=0.5 NC=1.4 RB=80 RBM=10 RC=20 TF=1n TR=.4u VAF=30
+ XCJC=0.4)
.MODEL GT402G PNP (BF=200 BR=9.5 CJC=580p CJE=400p EG=0.67 IKF=3.5 IKR=500m
+ IS=4.9u ISC=300n ISE=180n ITF=40.9u MJC=3.9 MJE=5.7 NE=1.9 NF=1.1 RC=200m
+ RE=400m TF=75.56n TR=96.58n VAF=18.3 VJC=850m VJE=850m VTF=10 XTF=1.79)
.MODEL GT404G NPN (BF=160 BR=9.4 CJC=2.86n CJE=2.08n EG=0.67 IKF=2.5 IKR=200m
+ IS=28u ISC=800n ISE=1.55u ITF=11.194m MJC=3.5 MJE=4.05 NE=2 NF=1.09 RB=5
+ RC=100m RE=440m TF=113n TR=448.17n VAF=35 VTF=10 XTF=500m)
.MODEL P214 PNP (BF=156 BR=4 CJC=315P CJE=1.07N IKF=3 IKR=4.5 IS=524N ISE=330N
+ NE=2 RB=.763 RC=76.3M RE=.190 TF=1.5U TR=3u VAF=106 VAR=40 XTB=1.5)
.MODEL MP39B PNP (BF=140 BR=3 CJC=90p CJE=30p EG=0.72 IKF=50m IRB=0.1m IS=3u
+ ISC=0.6u ISE=.3u MJC=0.5 MJE=0.5 NC=1.28 NE=1.28 RB=150 RBM=50 TF=0.2u TR=1.u
+ VAF=15)
.MODEL MP41 PNP (BF=140 BR=4 CJC=90p CJE=30p EG=0.72 IKF=50m IRB=0.1m IS=3u
+ ISC=0.6u ISE=.3u MJC=0.5 MJE=0.5 NC=1.28 NE=1.28 RB=150 RBM=50 TF=0.1u TR=1.u
+ VAF=15)
.MODEL MP37 NPN (BF=140 BR=4 CJC=90p CJE=30p EG=0.72 IKF=50m IRB=0.1m IS=3u
+ ISC=.6u ISE=.3u MJC=0.5 MJE=0.5 NC=1.28 NE=1.28 RB=150 RBM=50 TF=0.1u TR=1.u
+ VAF=15)
.MODEL MP35 NPN (BF=140 BR=4 CJC=90p CJE=50p EG=0.72 IKF=50m IRB=0.1m IS=3u
+ ISC=0.6u ISE=0.3u MJC=0.5 MJE=0.5 NC=1.28 NE=1.28 RB=150 RBM=50 TF=0.2u
+ TR=2.u VAF=15)
.MODEL MP25A_1 PNP (BF=140 BR=3 CJC=90p CJE=30p EG=0.72 IKF=40m IRB=0.1m IS=3u
+ ISC=.6u ISE=.3u MJC=0.5 MJE=0.5 NC=1.28 NE=1.28 RB=120 RBM=40 TF=0.4u TR=4u
+ VAF=30)
.MODEL P416B PNP (BF=800 BR=.3 CJC=15p CJE=20p EG=0.72 IKF=45m IRB=1m IS=100n
+ ISC=.7u ISE=25n MJC=0.5 MJE=0.5 NC=1.4 RB=80 RBM=10 RC=20 TF=1n TR=.4u VAF=30
+ XCJC=0.5)
.MODEL GT308B_1 PNP (BF=800 BR=.3 CJC=15p CJE=20p EG=0.72 IKF=45m IRB=1m
+ IS=100n ISC=.7u ISE=25n MJC=0.5 MJE=0.5 NC=1.4 RB=80 RBM=10 RC=20 TF=1n
+ TR=.4u VAF=30 XCJC=0.4)
```

```
.MODEL GT322A PNP (BR=.3 CJC=4p CJE=10p EG=0.72 IKF=20m IS=50n ISC=.5u ISE=10n
+ MJC=0.5 MJE=0.5 NC=1.4 RB=40 RC=10 TF=1n TR=.4u VAF=30 XCJC=0.3)
.MODEL GT311A NPN (BF=71.4 BR=1.3 CJC=7.5p CJE=10p IS=14e-12 RB=100 TF=10.7n
+ VJC=0.6)
*** From file C:\MC12\library\MSBJT.LBR
*** NPN Amplifer transistors
.MODEL BC546 NPN (BF=268.915 BR=2.62685 CJC=6.40421p CJE=19.7395p IKF=928.913m
+ IKR=463.061 IS=7.88857f ISC=3.68169p ISE=.000000121848f ITF=9.88981m
+ MJC=316.254m MJE=312.92m NE=2.07029 NF=968.124m RE=1.23191 TF=374.789p TR=10n
+ VAF=100 VJC=700m VJE=770.586m VTF=10 XTF=499.98m)
```

```
*** Warning any changes made to this page will be overwritten when an analysis is entered.

System:
    Version = 12.2.0.3 (64 bit)
    Executable date = Nov 18 2019
    RAM memory installed = 15.61 GB
    Windows version = WIN10 [Version=10.0.19045]
    ANSI Code page  = 1251
    User LID  = 0x419 русский (Russia)
    System LID  = 0x419 русский (Russia)

'C:\MC12\MCAP.INC' included
    .define 'DPWR(D)' 'I(D)*V(D)' is 'Not Used'
    .define 'BPWR(Q)' 'IC(Q)*VCE(Q)+IB(Q)*VBE(Q)' is 'Not Used'
    .define 'FPWR(M)' 'ID(M)*VDS(M)' is 'Not Used'
    .define 'HOTD(D,MAX)' 'IF((V(D)*I(D)>MAX),1,0)' is 'Not Used'
    .define 'HOTB(Q,MAX)' 'IF((VCE(Q)*IC(Q)+IB(Q)*VBE(Q)>MAX),1,0)' is 'Not Used'
    .define 'HOTF(M,MAX)' 'IF((VDS(M)*ID(M)>MAX),1,0)' is 'Not Used'
    .define 'LOW3MIN' 'IMPORT(LOW3MIN.OUT,LOW3THRES)' is 'Not Used'
    .define 'HIGH3MAX' 'IMPORT(HIGH3MAX.OUT,HIGH3THRES)' is 'Not Used'
    .define 'LOWLVDS' 'IMPORT(LOWLVDS.OUT,LOWLIMIT)' is 'Not Used'
    .define 'HILVDS' 'IMPORT(HILVDS.OUT,HILIMIT)' is 'Not Used'
    .define 'LIMTLVDS' 'IMPORT(LIMTLVDS.OUT,LVDSLIMITS)' is 'Not Used'
    .define 'SKINAC(DCRES,RESISTIVITY,RELPERM,RADIUS)' '((PI*RADIUS*RADIUS)/((PI*RADIUS*RADIUS)-PI*(RADIUS-SKINDEPTHAC
    .define 'SKINDEPTHAC(RESISTIVITY,RELPERM)' '503.3*(SQRT(RESISTIVITY/(RELPERM*F)))' is 'Not Used'
    .define 'SKINTR(DCRES,RESISTIVITY,RELPERM,RADIUS,FREQ)' '((PI*RADIUS*RADIUS)/((PI*RADIUS*RADIUS)-PI*(RADIUS-SKINDE
    .define 'SKINDEPTHTR(RESISTIVITY,RELPERM,FREQ)' '503.3*(SQRT(RESISTIVITY/(RELPERM*FREQ)))' is 'Not Used'
    .model 'PULSE22' 'PUL' 'Pulse' found in 'C:\MC12\MCAP.INC' is 'Not Used'

'C:\MC12\library\MEASURE.LIB' included
    .BEGIN_MEASURE FC_LP(X,DB=3.01) on page 'Text'
    .BEGIN_MEASURE FC_HP(X,DB=3.01) on page 'Text'
    .BEGIN_MEASURE BW(X,DB=3.01) on page 'Text'
    .BEGIN_MEASURE PULSE_WIDTH(X) on page 'Text'
    .BEGIN_MEASURE OVERSHOOT(X,TLIMIT) on page 'Text'
    .BEGIN_MEASURE PULSE_FREQ(X) on page 'Text'
    .BEGIN_MEASURE PULSE_PERIOD(X) on page 'Text'
    .BEGIN_MEASURE PULSE_DELAY(X,Y) on page 'Text'
    .BEGIN_MEASURE POWER_FACTOR(SRC,TSTART=0) on page 'Text'
    .BEGIN_MEASURE PW(X) on page 'Text'
    .BEGIN_MEASURE FALLTIME(X) on page 'Text'
    .BEGIN_MEASURE RISETIME(X) on page 'Text'

Main found in 'F:\MicroCap\Odissey_In.CIR' on page 'Main'
    .model '2N2221'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
    .model '2N2102'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
```

```
.model '2N930'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2DD2661'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3904'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3902'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC546B'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3866'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC547'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC546A'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC547B'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2222'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'UMT3904'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC550B'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC550C'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC550A'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC107B'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC108A'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC109B'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC317A'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC337'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC413'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BCP56-16_ZX'   'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BCV63'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BCW31'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BCX54'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BSR13'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MPSA05'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'ZXTN19060CG'   'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'ZXTN19020DG'   'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'ZXTN19020CFF'  'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'ZTX453'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2DC2412R'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2DC4617QLP'    'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2DC4617R'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2DC4672'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2DD1766Q'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2DD2652'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2DD2656'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2DD2678'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2DD2679'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N699'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Used'
.model '2N706'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N706A'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N706B'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N708'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N718'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N718A'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
```

```
.model '2N720A'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N835'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N1711'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N1893'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2102_ON'    'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2218'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2218A'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2219'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N1613'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N956'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N910'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N914'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N915'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N916'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N918'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N930A'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2219A'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2221A'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2222A'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2222AUB'    'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2270'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2368'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2369'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2369A'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2405'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2481'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2484'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2501'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2857'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2857UB'     'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N2916'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3011'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3019'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3020'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3053'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3053A'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3054'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3054A'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3055'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3055A'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3055H'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3114'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3117'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3227'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3252'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3253'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
```

```
.model '2N3300'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3302'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3390'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3391A'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3392'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3393'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3415'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3416'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3417'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3421'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3439'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3440'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3441'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3442'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3444'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3447'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3498'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3499'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3500'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3501'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3506'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3507'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3583'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3584'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3585'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3648'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3700'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3704'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC337_16'     'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BF469'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC108B'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BC107A'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BCP55'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BCP54'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BCW32'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BCX55'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model '2N3903'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MJD340'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'Q2N3904'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'Q2N2102'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'QBC547B'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'QBC846BLT1G'  'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'QBD139'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'QBD179'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'SMBT2222'     'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'SMBT2222A'    'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
```

```
.model 'BC548C'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BD135_16'     'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BD135_6'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'QPZT2222AT1'  'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'QBD135'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'QBCP56'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'PZT2222'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MPSA42'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MPSA18'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MPSA45'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MPSA43'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MPSA44'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MPSA06'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MPS3904'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MMST3904'     'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MMBTA05'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MMBT5551'     'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MMBT4401'     'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MMBT3904'     'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MJE13003'     'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MJE340'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'KSC2881'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'KSC1815'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'KSC1845'      'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BFV420'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BFV469'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BFP22'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BFN24'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BFN16'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BF869'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'BF420'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'AC127'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'AC128'        'PNP' 'Bipolar Junction Transistors PNP' on page 'Models' is 'Not Used'
.model 'MP14'         'PNP' 'Bipolar Junction Transistors PNP' on page 'Models' is 'Not Used'
.model 'MP10'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MP25A'        'PNP' 'Bipolar Junction Transistors PNP' on page 'Models' is 'Not Used'
.model 'GT308B'       'PNP' 'Bipolar Junction Transistors PNP' on page 'Models' is 'Not Used'
.model 'GT402G'       'PNP' 'Bipolar Junction Transistors PNP' on page 'Models' is 'Not Used'
.model 'GT404G'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'P214'         'PNP' 'Bipolar Junction Transistors PNP' on page 'Models' is 'Not Used'
.model 'MP39B'        'PNP' 'Bipolar Junction Transistors PNP' on page 'Models' is 'Not Used'
.model 'MP41'         'PNP' 'Bipolar Junction Transistors PNP' on page 'Models' is 'Not Used'
.model 'MP37'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Used'
.model 'MP35'         'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
.model 'MP25A_1'      'PNP' 'Bipolar Junction Transistors PNP' on page 'Models' is 'Not Used'
.model 'P416B'        'PNP' 'Bipolar Junction Transistors PNP' on page 'Models' is 'Not Used'
```

```
    .model 'GT308B_1'     'PNP' 'Bipolar Junction Transistors PNP' on page 'Models' is 'Not Used'
    .model 'GT322A'       'PNP' 'Bipolar Junction Transistors PNP' on page 'Models' is 'Not Used'
    .model 'GT311A'       'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
    .model 'BC546'        'NPN' 'Bipolar Junction Transistors NPN' on page 'Models' is 'Not Used'
    .model 'BZD27C6V8'    'D'   'Diode' found in 'C:\MC12\library\VISHAYDIODE.LIB' is 'Used'

Components:
    Resistor = 24
    Capacitor = 12
    Diode = 1
    NPN = 3
    VSpice = 3
    Components = 43

Files Used:
    C:\MC12\MCAP.INC
    C:\MC12\library\MEASURE.LIB
    F:\MicroCap\Odissey_In.CIR
    C:\MC12\library\VISHAYDIODE.LIB

Analog Nodes = 29
Digital Nodes = 0

Timings:
    Run Time = 0.234 Seconds
    Setup Time = 0.187 Seconds
    Load Time = 0 Seconds
    Solve Time = 0.015 Seconds
    Numeric Output Time = 0.016 Seconds

    Total Iterations = 8,440
    Rejected Solutions = 0
    Total Solutions = 4,219
    Number of Equations = 32

Data Points:
    Analog Data Points Per Waveform = 16,384
    HARM(V(R12)) = 16,384 Data Pts
    V(R12) = 16,384 Data Pts
    THD(HARM(V(R12))) = 16,384 Data Pts
    THDN(HARM(V(R12))) = 16,384 Data Pts
    HARM(I(V1)) = 16,384 Data Pts
    Total Data Points = 81,915

Simulation Log:
    Start parsing circuit for Harmonic Distortion Analysis
```

```
End parsing circuit for Harmonic Distortion Analysis 0.187 Seconds

Start Harmonic Distortion Analysis run

Stepping F=1000 VIN=25M
Phase 0: Solving for the operating point...
Phase 0: Standard Newton-Raphson. Succeeded. Iterations =   30 Fillins =  16
Starting Harmonic Distortion Analysis.
Harmonic Distortion Analysis start AC Fillins=0
Harmonic Distortion Analysis end AC Fillins=16

End Harmonic Distortion Analysis run 0.234 Seconds
```