

Appendix C

SAMPLE SPICE MODELS

Modpex 2N3904 and Fairchild 2N3904

Use with permission of Fairchild Semiconductor

C.1 SOURCE: MODPEX 2N3904/2N3906 MODEL

Note: Modpex/Symmetry was purchased by Analogy (SABER/MAST) that was then bought by Avant!, that was then bought by Synopsys. I thought this interesting because it is the generation of SPICE models from data sheet characteristic curves.

```
*****
*   Model Generated by MODPEX   *
*Copyright(c) Symmetry Design Systems*
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*****
* Model generated on Apr 22, 96
.MODEL 2N3904 npn
+IS=6.9716e-14 BF=545.416 NF=1.09328 VAF=10
+IKF=0.0228393 ISE=5.71808e-12 NE=1.88204 BR=4.70256
+NR=1.3912 VAR=2.31769 IKR=0.074093 ISC=5.71808e-12
+NC=1.36259 RB=1.733 IRB=1.12054 RBM=0.876202
+RE=0.356192 RC=1.78096 XTB=0.1 XTI=1
+EG=1.05 CJE=4.47982e-12 VJE=0.4 MJE=0.240345
+TF=4e-10 XTF=1.5 VTF=1 ITF=1
+CJC=3.76637e-12 VJC=0.4 MJC=0.241382 XCJC=0.8
+FC=0.533333 CJS=0 VJS=0.75 MJS=0.5
```

```
+TR=3.77901e-05 PTF=0 KF=0 AF=1
*****
*   Model Generated by MODPEX   *
*Copyright(c) Symmetry Design Systems*
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.MODEL 2N3906 pnp
+IS=1.14615e-14 BF=535.453 NF=1.06473 VAF=10
+IKF=0.0234918 ISE=1.33613e-13 NE=1.62939 BR=4.66099
+NR=1.19618 VAR=2.77165 IKR=0.0740931 ISC=1.33613e-13
+NC=1.22182 RB=0.1 IRB=1.05964 RBM=0.1
+RE=0.0001 RC=1.39183 XTB=0.1 XTI=1
+EG=1.05 CJE=6.03788e-12 VJE=0.4 MJE=0.272764
+TF=4.8381e-10 XTF=1.5 VTF=1 ITF=1
+CJC=6.18444e-12 VJC=0.4 MJC=0.234098 XCJC=0.8
+FC=0.5415 CJS=0 VJS=0.75 MJS=0.5
+TR=2.42096e-06 PTF=0 KF=0 AF=1
```

C.2 FAIRCHILD SEMICONDUCTOR 2N3904–2N3906 MODEL

```
.model 2N3904 NPN(Is=6.734f Xti=3 Eg=1.11 Vaf=74.03 Bf=416.4 Ne=1.259
+       Ise=6.734f Ikf=66.78m Xtb=1.5 Br=.7371 Nc=2 Isc=0 Ikr=0 Rc=1
+       Cjc=3.638p Mjc=.3085 Vjc=.75 Fc=.5 Cje=4.493p Mje=.2593 Vje=.75
+       Tr=239.5n Tf=301.2p Itf=.4 Vtf=4 Xtf=2 Rb=10)
*       Fairchild    pid=23      case=TO92
*       88-09-08 bam   creation
```

```
.model 2N3906 PNP(Is=1.41f Xti=3 Eg=1.11 Vaf=18.7 Bf=180.7 Ne=1.5 Ise=0
+       Ikf=80m Xtb=1.5 Br=4.977 Nc=2 Isc=0 Ikr=0 Rc=2.5 Cjc=9.728p
+       Mjc=.5776 Vjc=.75 Fc=.5 Cje=8.063p Mje=.3677 Vje=.75 Tr=33.42n
+       Tf=179.3p Itf=.4 Vtf=4 Xtf=6 Rb=10)
*       Fairchild    pid=66      case=TO92
*       88-09-09 bam   creation
```