CA3096 and CA3083 Transistor Array SPICE Models

July 1997 MM9710

Introduction

This application note describes the SPICE transistor models for the bipolar devices that comprise the CA3096, and the CA3083 High Frequency NPN/PNP Transistor Arrays.

Model Description

While this model was developed for the PSPICE simulator from MicroSim Corporation, it may be adaptable to other simulators. The performance curves included in this document were generated using PSPICE.

SPICE simulations should not be considered a substitute for breadboarding a circuit; rather, they should be used to select preliminary component values and to verify the validity of a design approach. This model emulates typical rather than worst case devices, at an ambient temperature of $25^{o}C$.

Model Performance

Several model performance curves have been included to show how accurately the models match the actual device characteristics. The squares shown in the graphs represent data points taken from the data sheet. These data points show that the model correlates closely to the data sheet specifications.

Parameters Not Modeled

Some effects haven't been included in this model. The major exclusions are listed below:

- Temperature Effects
- Breakdown Effects
- f_T vs V_{CE} Variations
- Reverse Operation Characteristics

PSPICE Listing

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*
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*
*CA3096 NPN PSPICE MODEL
*REV: 3-13-97
**      -----  BJT MODEL -----
*
.model CA3096 NPN
+           (IS = 10.0E - 15          XTI = 3.000E + 00      EG = 1.110E + 00      VAF = 1.00E + 02
+           VAR = 1.000E + 02         BF = 466.5E + 00       ISE = 74.286E - 15    NE = 1.660E + 00
+           IKF = 14.000E - 03        XTB = 0.000E + 00      BR = .1000E + 00      ISC = 10.005E - 15
+           NC = 2.000E + 00          IKR = 10.00E - 03      RC = 10.000E + 00     CJC = 786.51E - 15
+           MJC = 0.333E - 00         VJC = 0.7500E - 00     FC = 5.000E - 01      CJE = 1.28E - 12
+           MJE = .336E- 00           VJE = 0.750E - 00      TR = 10.000E - 09     TF = 490.01E - 12
+           ITF = .270E - 00          XTF = 5.38E + 00       VTF = 28.39E + 00     PTF = 0.000E + 00
+           RE = 0.0E + 00            RB = 0.00E + 00        NK = .468

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*
*CA3096 PNP Spice MODEL
*REV: 3-13-97
**      -----  BJT MODEL -----
*
.model CA3096 PNP
+           (IS = 10.0E - 15          XTI = 3.000E + 00      EG = 1.110E + 00      VAF = 1.00E + 02
+           VAR = 1.000E + 02         BF = 94.5E + 00        ISE = 976.47E - 15    NE = 1.990E + 00
+           IKF = 1.1100E - 03        XTB = 0.000E + 00      BR = .1000E + 00      ISC = 10.005E - 15
+           NC = 2.000E + 00          IKR = 10.00E - 03      RC = 10.000E + 00     CJC = 3.84E - 12
+           MJC = 0.333E - 00         VJC = 0.7500E - 00     FC = 5.000E - 01      CJE = 1.45E - 12
+           MJE = .336E- 00           VJE = 0.750E - 00      TR = 10.000E - 09     TF = 24.3E - 9
+           ITF = 1.25E - 00          XTF = 10.05E + 00      VTF = 9.79E + 00      PTF = 0.000E + 00
+           RE = 0.0E + 00            RB = 0.00E + 00        NK = .53

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*
*CA3083 NPN PSPICE MODEL
*REV: 3-13-97
**      -----  BJT MODEL -----
*
.model CA3083 NPN
+           (IS = 10.0E - 15          XTI = 3.000E + 00      EG = 1.110E + 00      VAF = 1.00E + 02
+           VAR = 1.000E + 02         BF = 112.8E + 00       ISE = 99.086E - 15    NE = 1.410E + 00
+           IKF = 120.900E - 03       XTB = 0.000E + 00      BR = 16.0E + 00       ISC = 116.12E - 15
+           NC = 1.700E + 00          IKR = 29.800E - 03     RC = 10.000E + 00     CJC = 991.71E - 15
+           MJC = 0.333E - 00         VJC = 0.7500E - 00     FC = 5.000E - 01      CJE = 1.02E - 12
+           MJE = .333E- 00           VJE = 0.750E - 00      TR = 10.000E - 09     TF = 275.61E - 12
+           ITF = .3750E - 00         XTF = 91.950E + 00     VTF = 8.90E + 00      PTF = 0.000E + 00
+           RE = 0.0E + 00            RB = 0.00E + 00
```

CA3096 NPN Model Performance

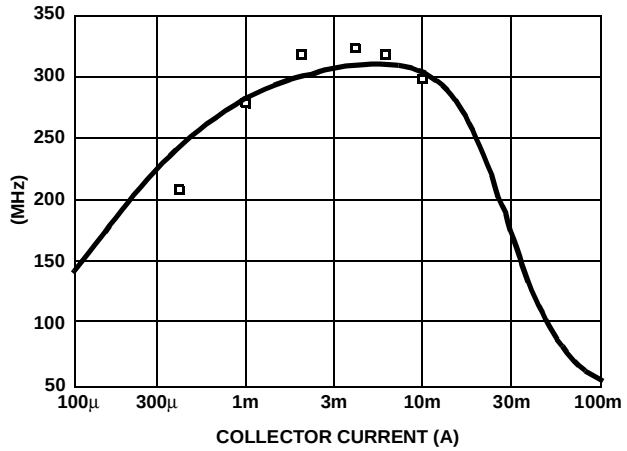

FIGURE 1. CA3096 NPN f_T vs I_C

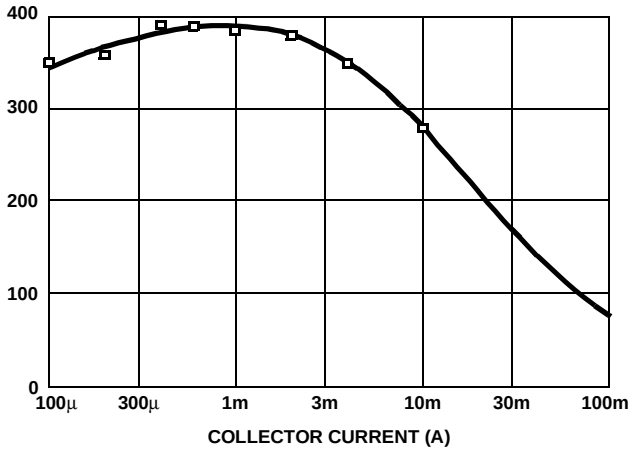

FIGURE 2. CA3096 NPN h_{FE} vs I_C

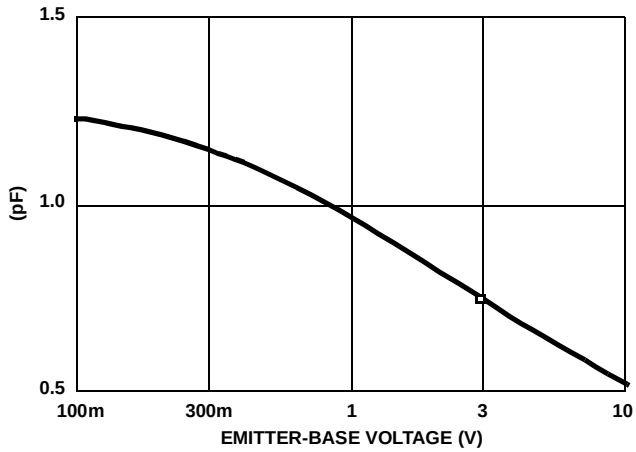

FIGURE 3. CA3096 NPN C_{EB} vs V_{EB}

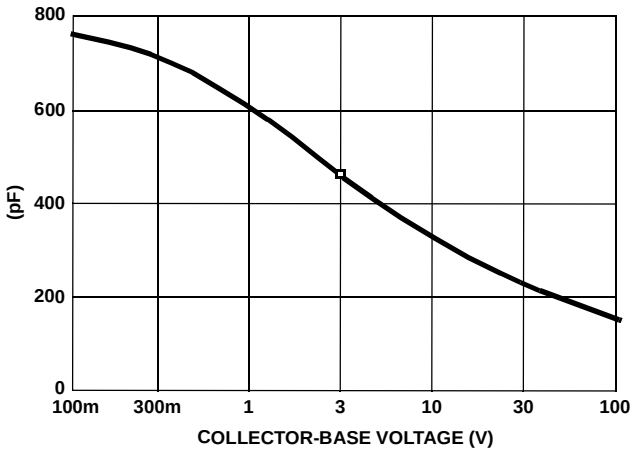

FIGURE 4. CA3096 NPN C_{CB} vs V_{CB}

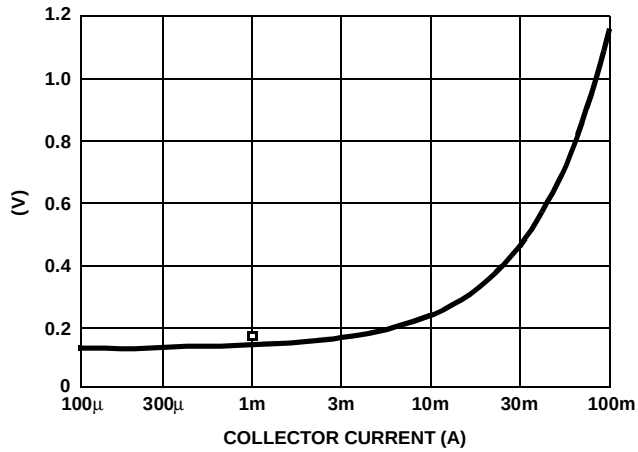

FIGURE 5. CA3096 NPN $V_{CE(SAT)}$ vs I_C

CA3096 PNP Model Performance

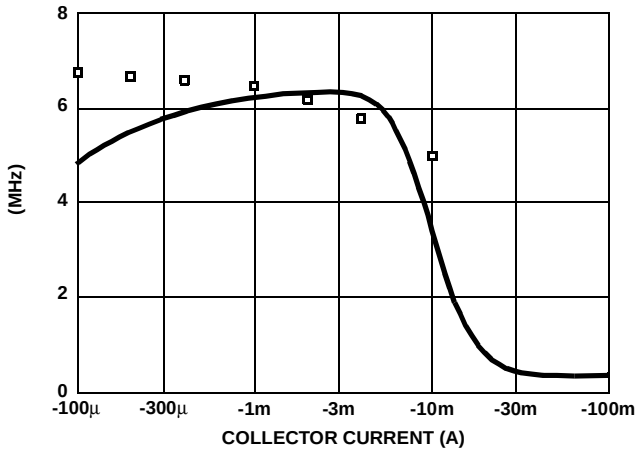

FIGURE 6. CA3096 PNP f_T vs I_C

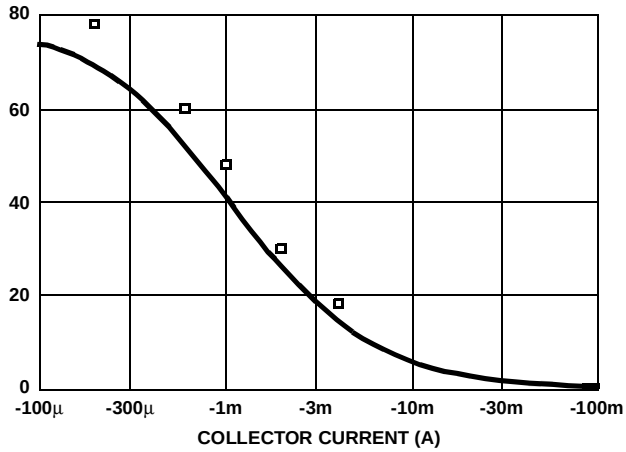

FIGURE 7. CA3096 PNP h_{FE} vs I_C

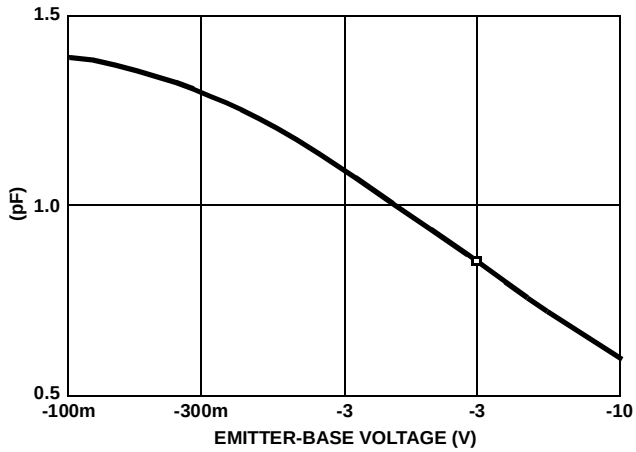

FIGURE 8. CA3096 PNP C_{EB} vs V_{EB}

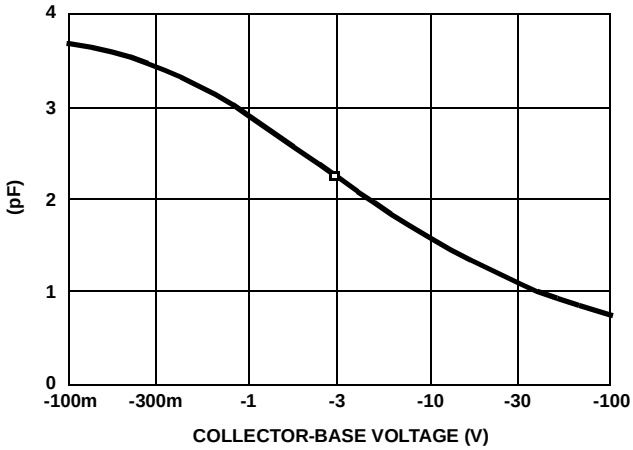

FIGURE 9. CA3096 PNP C_{CB} vs V_{CB}

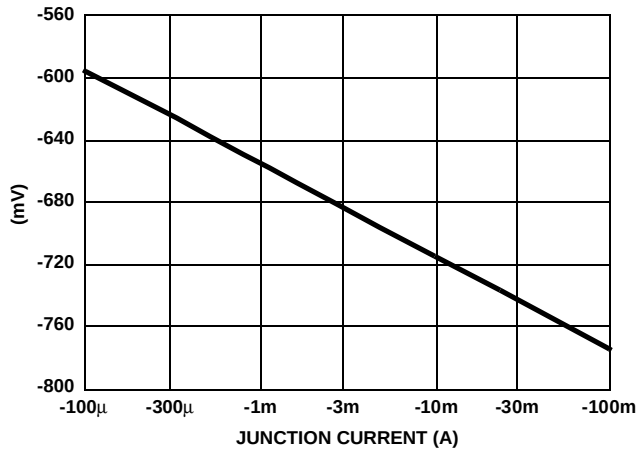

FIGURE 10. CA3096 PNP V_{BE} vs I_B

CA3083 Model Performance

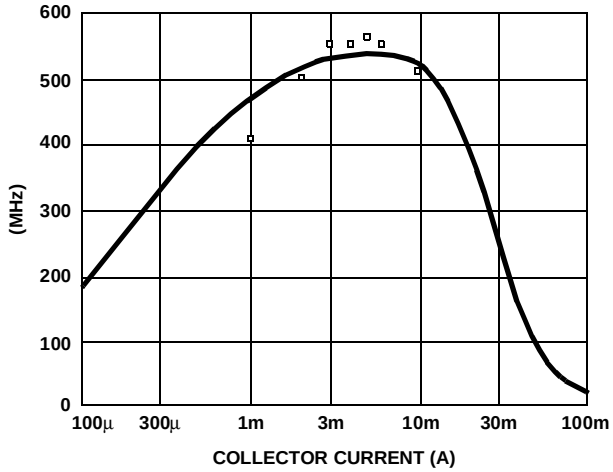

FIGURE 11. CA3083 f_T vs I_C

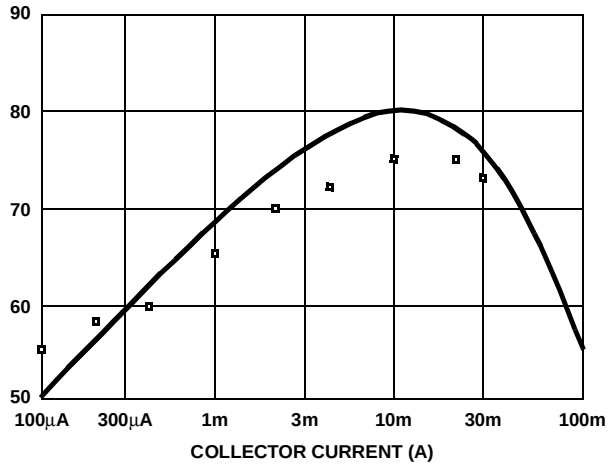

FIGURE 12. CA3083 h_{FE} vs I_C

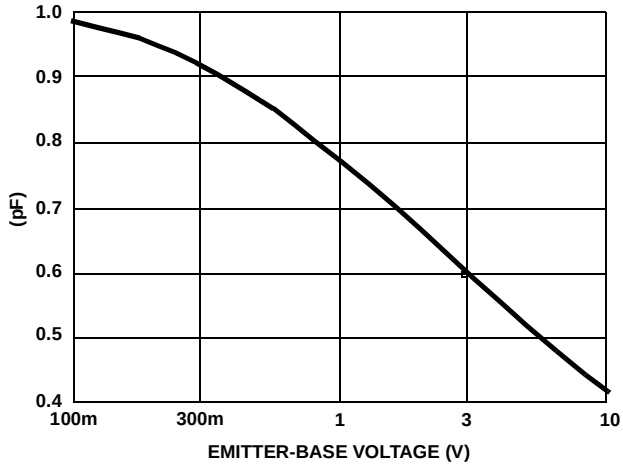

FIGURE 13. CA3083 C_{EB} vs V_{EB}

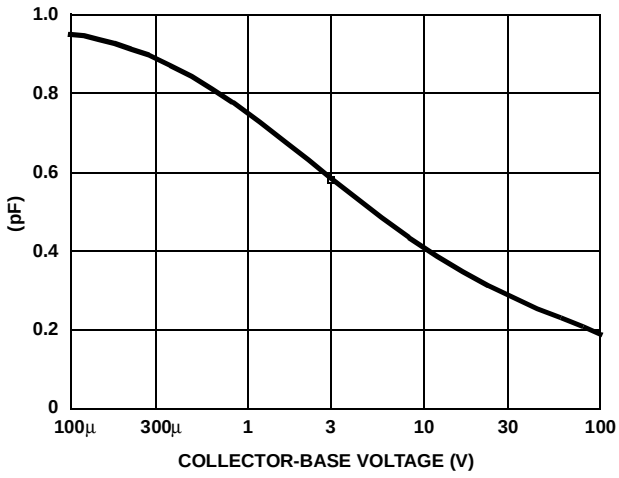

FIGURE 14. CA3083 C_{CB} vs V_{CB}

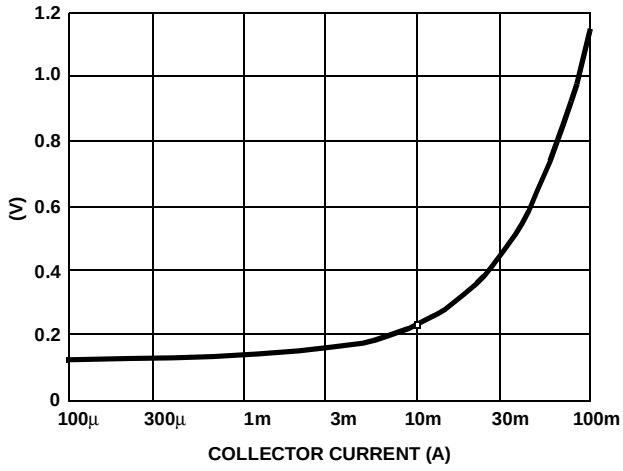

FIGURE 15. CA3083 $V_{CE(SAT)}$ vs I_C

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