

CA3046, CA3086, CA3127 Transistor Array SPICE Models

Application Note

June 1997

MM9701

Introduction

This application note describes the SPICE transistor models for the bipolar devices that comprise the CA3046, CA3086, and the CA3127 High Frequency NPN 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°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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*COPYRIGHT © 1997 INTERSIL CORPORATION
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*CA3046 PSpice MODEL
*REV: 2-24-97
    ---- BJT MODEL ----
.model CA3046 NPN
         (IS = 10.0E - 15)
                                 XTI = 3.000E + 00
                                                        EG = 1.110E + 00
                                                                               VAF = 1.00E + 02
       VAR = 1.000E + 02
                                 BF = 145.7E + 00
                                                        ISE = 114.286E - 15
                                                                                NE = 1.480E + 00
        IKF = 46.700E - 03
                               XTB = 0.000E + 00
                                                        BR = .1000E + 00
                                                                                ISC = 10.005E - 15
+
                                                        RC = 10.000E + 00
+
        NC = 2.000E + 00
                                IKR = 10.00E - 03
                                                                               CJC = 991.71E - 15
       MJC = 0.333E - 00
                                VJC = 0.7500E - 00
                                                         FC = 5.000E - 01
                                                                               CJE = 1.02E - 12
+
       MJE = .336E - 00
                                VJE = 0.750E - 00
                                                        TR = 10.000E - 09
                                                                                 TF = 277.01E - 12
        ITF = 1.750E - 00
                               XTF = 309.38E + 00
                                                       VTF = 16.37E + 00
                                                                               PTF = 0.000E + 00
        RE = 0.0E + 00
                                RB = 0.00E + 00
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*CA3086 PSpice MODEL
*REV: 2-24-97
    ---- BJT MODEL ----
.model CA3086 NPN
        (IS = 10.0E - 15)
                                 XTI = 3.000E + 00
                                                        EG = 1.110E + 00
                                                                               VAF = 1.00E + 02
+
       VAR = 1.000E + 02
                                 BF = 156.6E + 00
                                                        ISE = 114.886E - 15
                                                                                NE = 1.470E + 00
        IKF = 36.700E - 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 = 991.79E - 15
+
       MJC = 0.333E - 00
                               VJC = 0.7500E - 00
                                                         FC = 5.000E - 01
                                                                               CJE = 1.02E - 12
+
       MJE = .336E - 00
                                VJE = 0.750E - 00
                                                         TR = 10.000E - 09
                                                                                 TF = 278.55E - 12
+
        ITF = .770E - 00
                                                       VTF= 18.37E + 00
                                                                               PTF = 0.000E + 00
                                XTF = 91.38E + 00
        RE = 0.0E + 00
                                RB = 0.00E + 00
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*CA3127 PSpice MODEL
*REV: 2-13-97
    ---- BJT MODEL ----
.model CA3127 NPN
                                 XTI = 3.000E + 00
                                                        EG = 1.110E + 00
                                                                               VAF = 1.00E + 02
+
        (IS = 3.20E - 12)
       VAR = 1.000E + 02
                                 BF = 95.2E + 00
                                                        ISE = 20.586E - 12
                                                                                NE = 1.990E + 00
+
        IKF = 61.500E - 03
                               XTB = 0.000E + 00
                                                                                ISC = 10.805E - 9
                                                        BR = .1000E + 00
        NC = 2.000E + 00
                                IKR = 10.00E - 03
                                                        RC = 10.000E + 00
                                                                               CJC = 281.1E - 15
+
       MJC = 0.138E - 00
                                VJC = 0.7500E - 00
                                                        FC = 5.000E - 01
                                                                               CJE = 651.9E - 15
+
       MJE = .336E - 00
                                VJE = 0.750E - 00
                                                        TR = 10.000E - 09
                                                                                 TF = 122.61E - 12
+
        ITF = 1.600E - 00
                               XTF = 2.050E + 03
                                                        VTF = 307.00E + 00
                                                                               PTF = 0.000E + 00
        RE = 0.0E + 00
                                RB = 0.00E + 00
```

CA3046 Model Performance

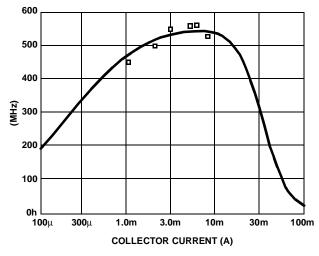


FIGURE 1. CA3046 f_T vs I_C

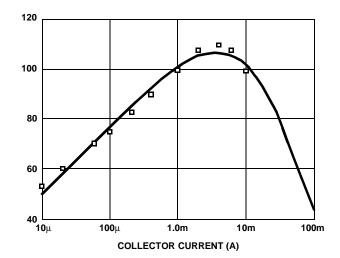


FIGURE 2. CA3046 $h_{\mbox{\scriptsize FE}}$ vs $I_{\mbox{\scriptsize C}}$

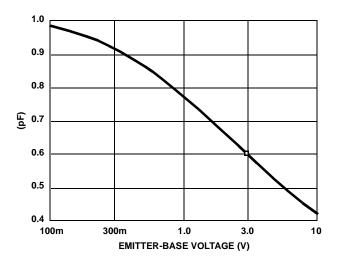


FIGURE 3. CA3046 C_{EB} vs V_{EB}

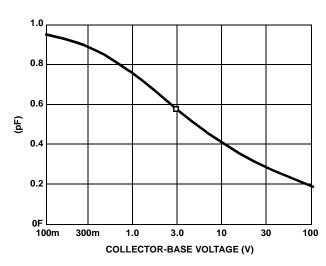


FIGURE 4. CA3046 C_{CB} vs V_{CB}

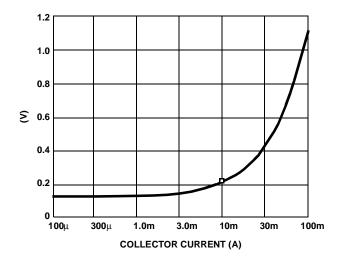
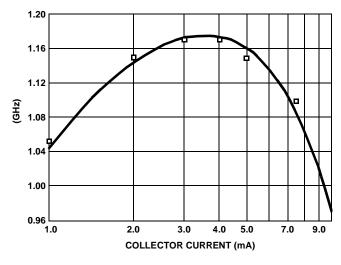


FIGURE 5. CA3046 V_{CE(SAT)} vs I_C

CA3127 Model Performance



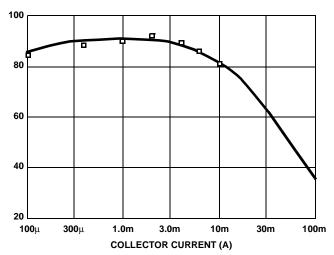
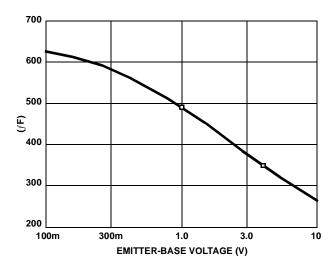


FIGURE 6. CA3127 f_T vs I_C

FIGURE 7. CA3127 $h_{\mbox{\scriptsize FE}}$ vs I $_{\mbox{\scriptsize C}}$



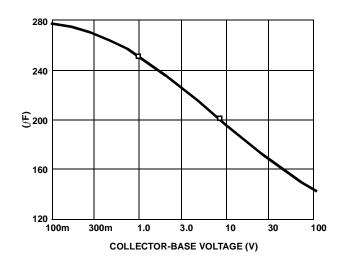


FIGURE 8. CA3127 C_{EB} vs V_{EB}

FIGURE 9. CA3127 $\mathrm{C_{CB}}\ \mathrm{vs}\ \mathrm{V_{CB}}$

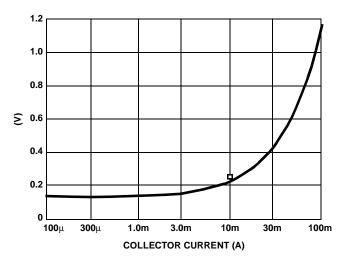
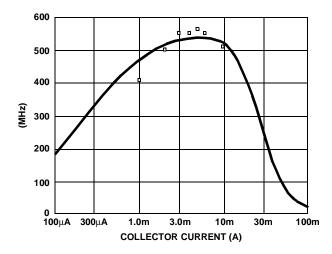


FIGURE 10. CA3127 $V_{CE(SAT)}$ vs I_C

120

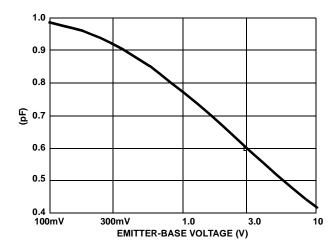
CA3086 Model Performance



100 80 60 100 μA 300 μA 1.0m 3.0m 10m 30m 100m COLLECTOR CURRENT (A)

FIGURE 11. CA3086 f_T vs I_C

FIGURE 12. CA3086 $h_{\mbox{\scriptsize FE}}$ vs $I_{\mbox{\scriptsize C}}$



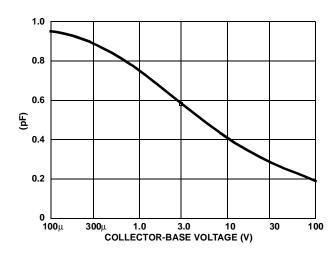


FIGURE 13. CA3086 C_{EB} vs V_{EB}

FIGURE 14. CA3086 C_{CB} vs V_{CB}

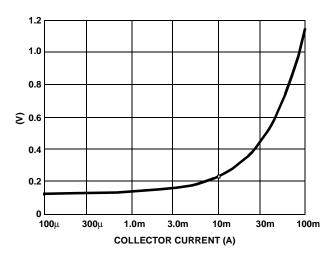


FIGURE 15. CA3086 $V_{CE(SAT)}$ vs I_C

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