Harris Semiconductor

APPNOTE

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Harris Linear

CA3046, CA3086, CA3127
Transistor Array SPICE Models

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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 $25^{o}C$.

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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*
*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
+           NC =  2.000E + 00         IKR =  10.00E - 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 =  .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         XTF =  91.38E + 00       VTF =  18.37E + 00       PTF =  0.000E + 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
+           (IS =  3.20E - 12          XTI=  3.000E + 00        EG =  1.110E + 00        VAF =  1.00E + 02
+          VAR =  1.000E + 02          BF =  95.2E + 00        ISE =  20.586E - 12        NE =  1.990E + 00
+           IKF =  61.500E - 03       XTB =  0.000E + 00        BR =  .1000E + 00        ISC =  10.805E - 9
+           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

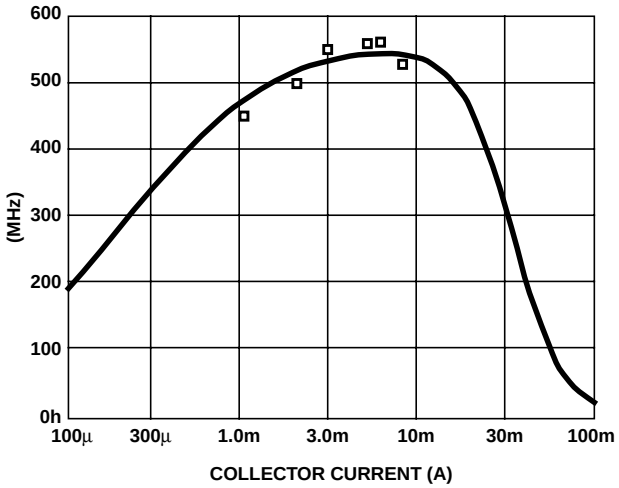

FIGURE 1. CA3046 f_T vs I_C

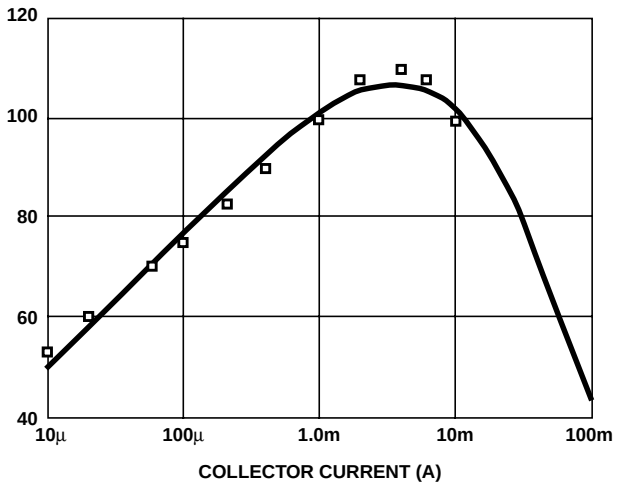

FIGURE 2. CA3046 h_{FE} vs I_C

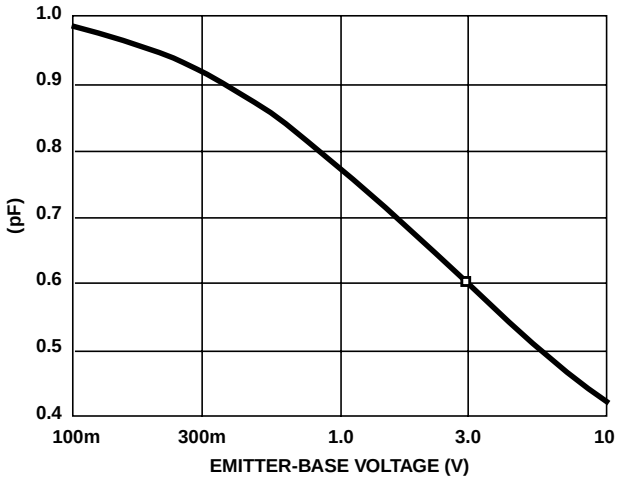

FIGURE 3. CA3046 C_{EB} vs V_{EB}

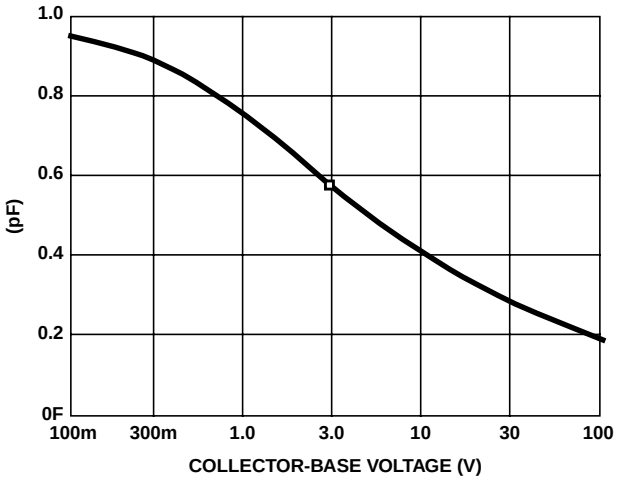

FIGURE 4. CA3046 C_{CB} vs V_{CB}

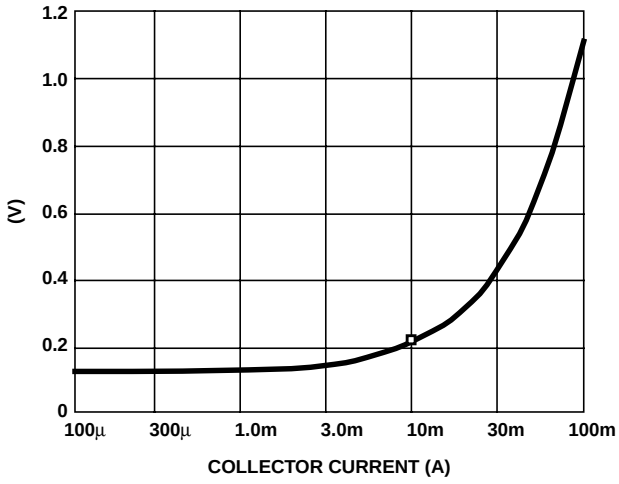

FIGURE 5. CA3046 $V_{CE(SAT)}$ vs I_C

CA3127 Model Performance

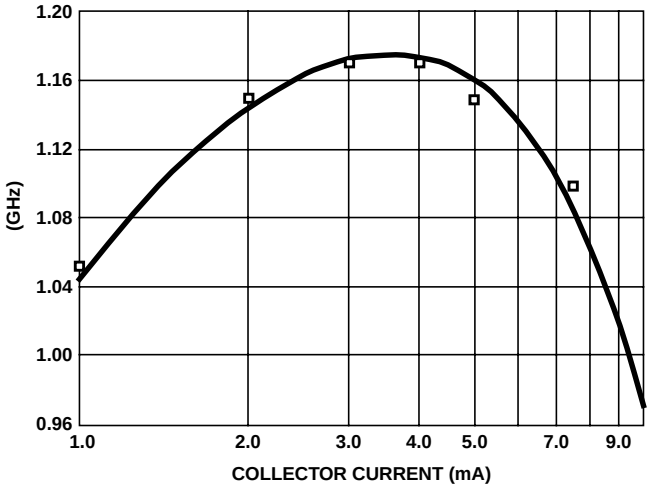

FIGURE 6. CA3127 f_T vs I_C

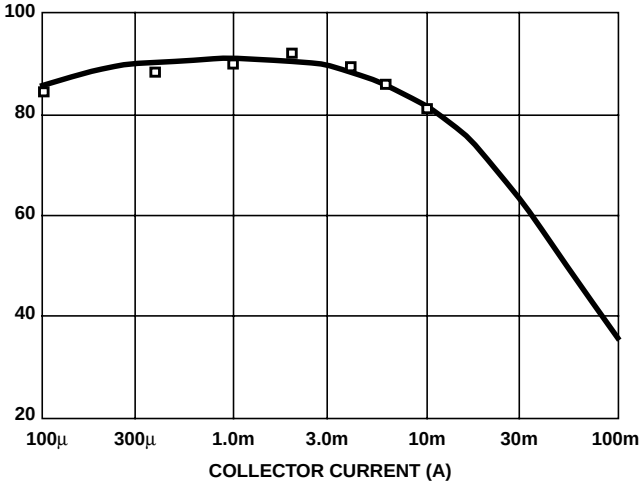

FIGURE 7. CA3127 h_{FE} vs I_C

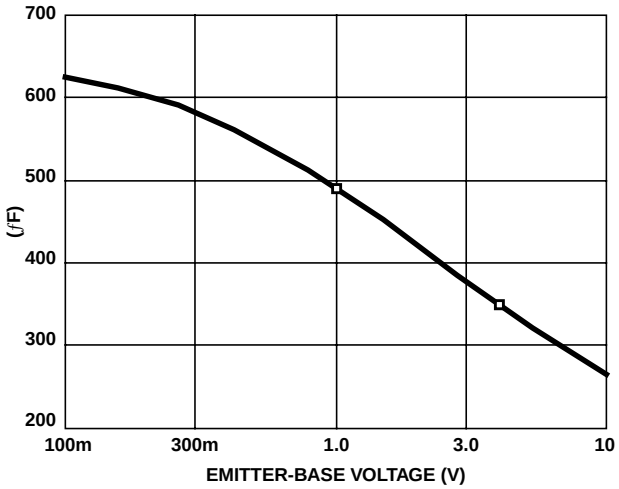

FIGURE 8. CA3127 C_{EB} vs V_{EB}

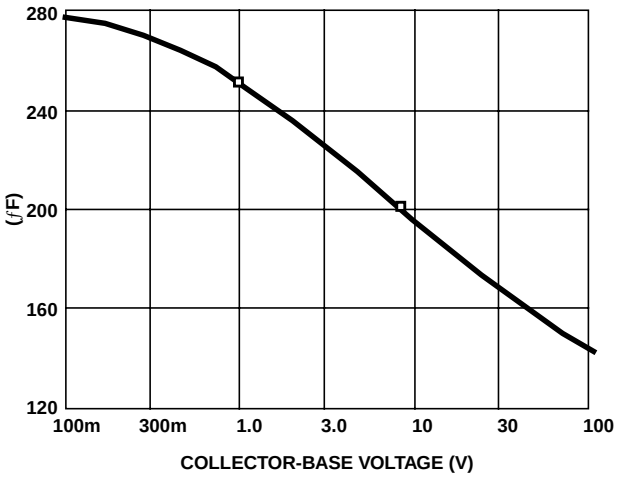

FIGURE 9. CA3127 C_{CB} vs V_{CB}

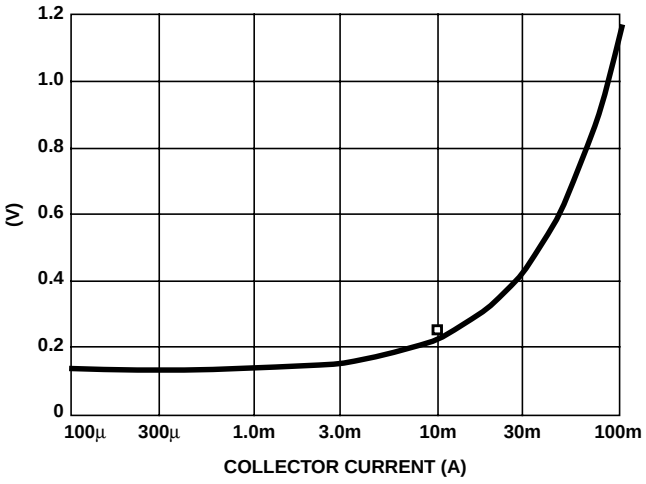

FIGURE 10. CA3127 $V_{CE(SAT)}$ vs I_C

CA3086 Model Performance

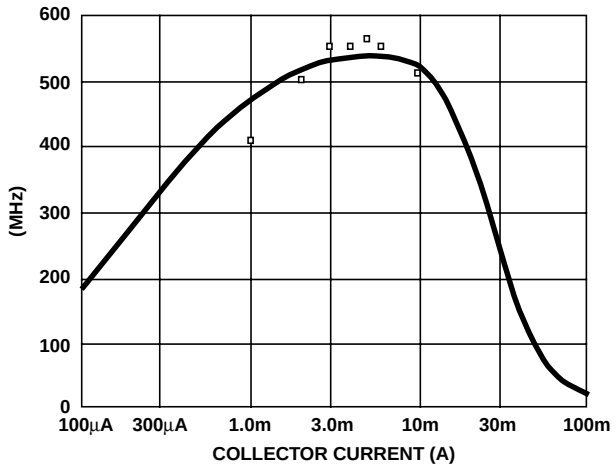

FIGURE 11. CA3086 f_T vs I_C

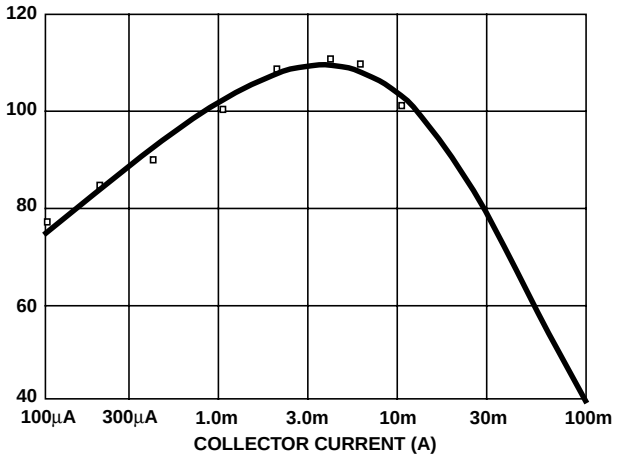

FIGURE 12. CA3086 h_{FE} vs I_C

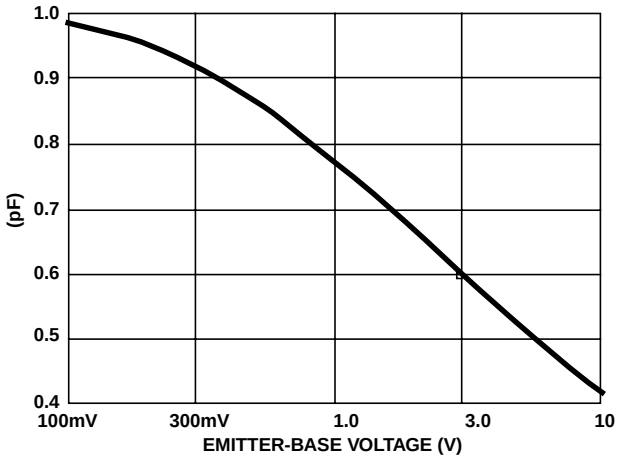

FIGURE 13. CA3086 C_{EB} vs V_{EB}

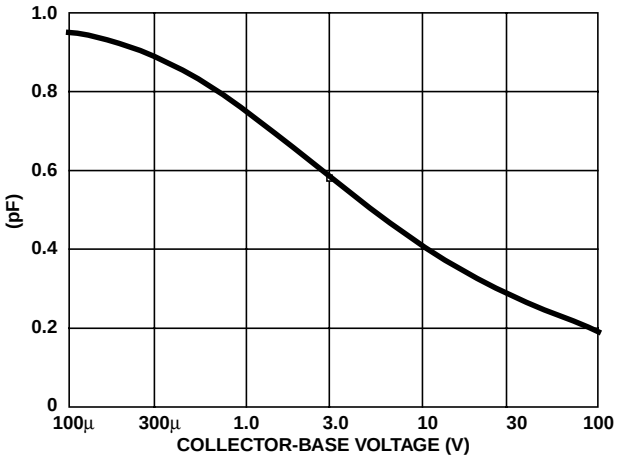

FIGURE 14. CA3086 C_{CB} vs V_{CB}

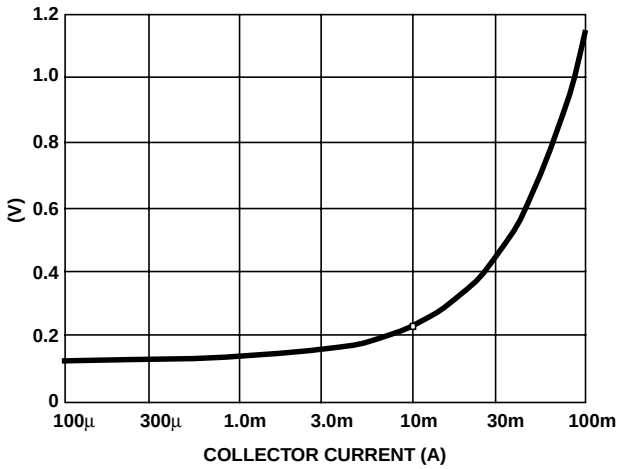

FIGURE 15. CA3086 $V_{CE(SAT)}$ vs I_C