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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*
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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
```
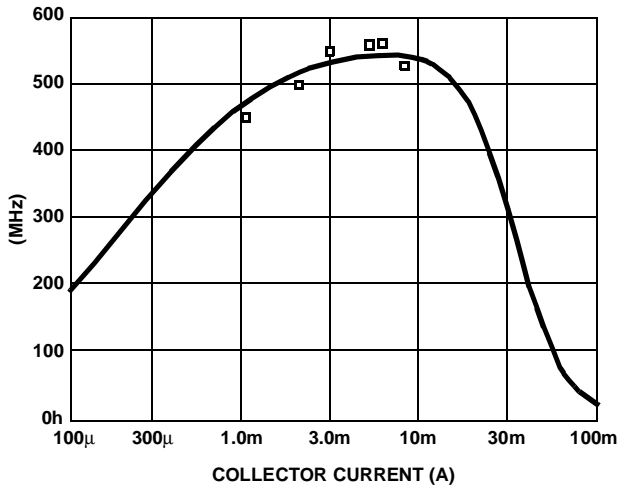
CA3046 Model Performance
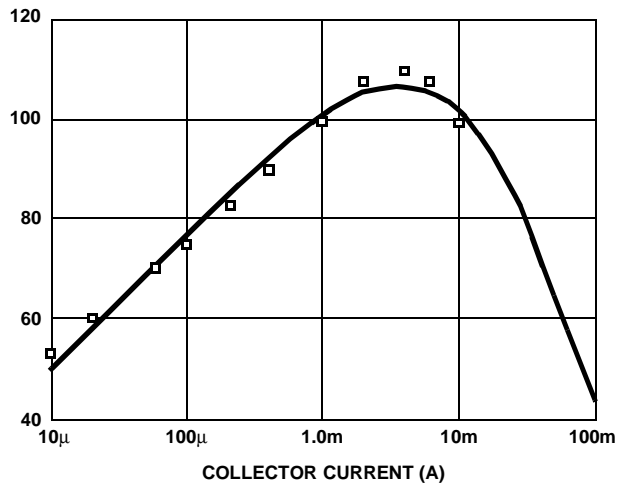
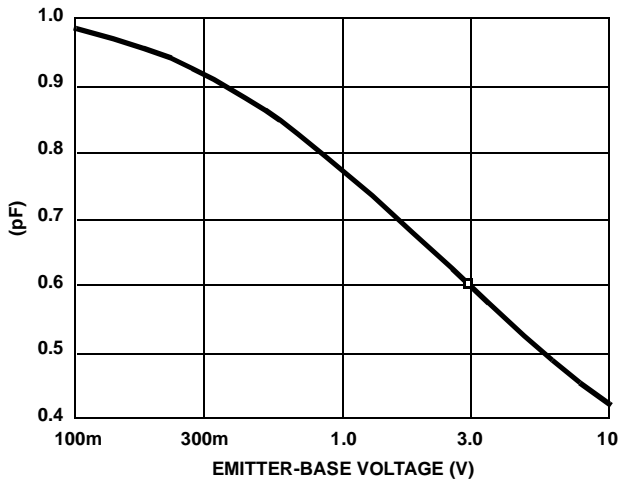FIGURE 1. CA3046 f_T vs I_C

FIGURE 2. CA3046 h_{FE} vs I_C

FIGURE 3. CA3046 C_{EB} vs V_{EB}
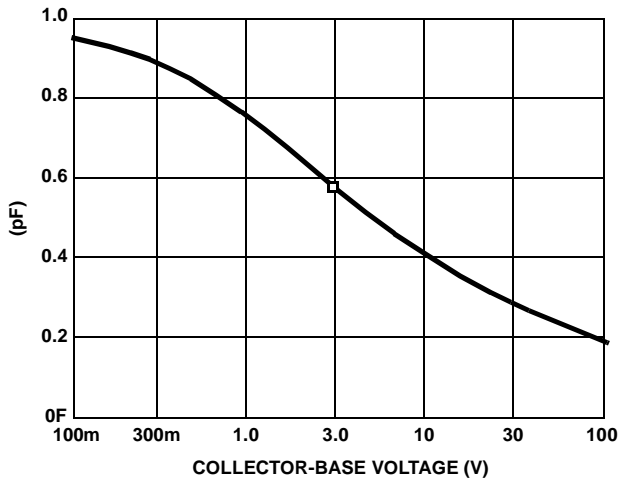
FIGURE 4. CA3046 C_{CB} vs V_{CB}
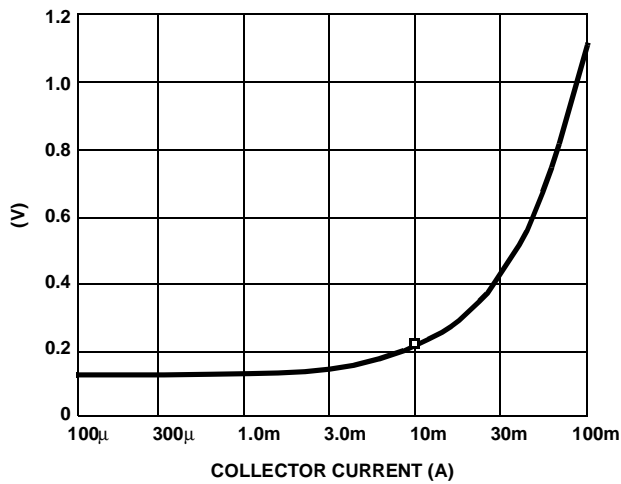
FIGURE 5. CA3046 $V_{CE(SAT)}$ vs I_C
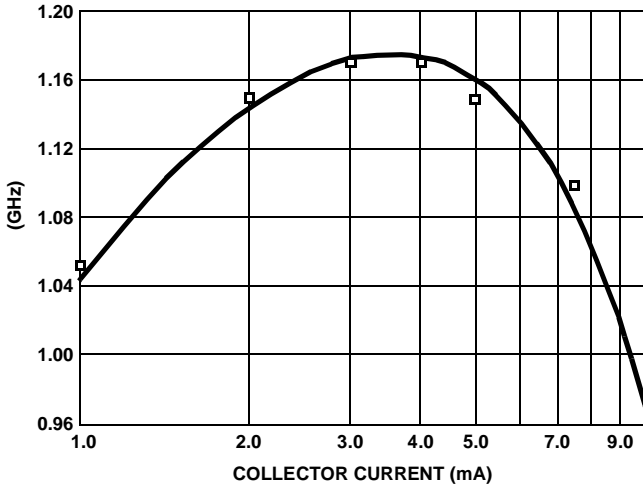
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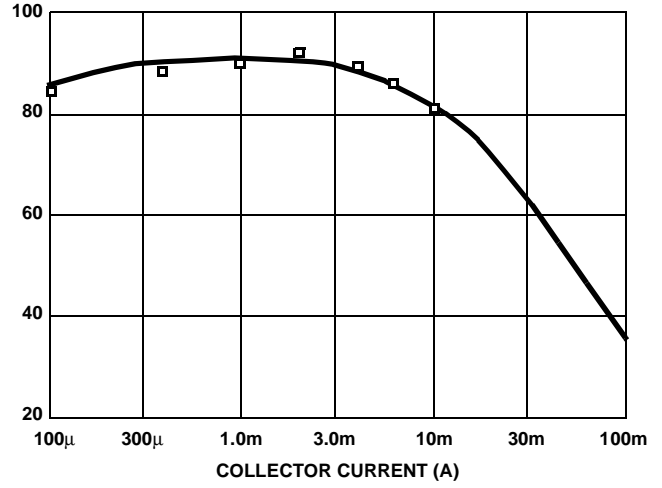## *CA3127 Model Performance*

FIGURE 6. CA3127 f$_T$ vs I$_C$

FIGURE 7. CA3127 h$_{FE}$ vs I$_C$
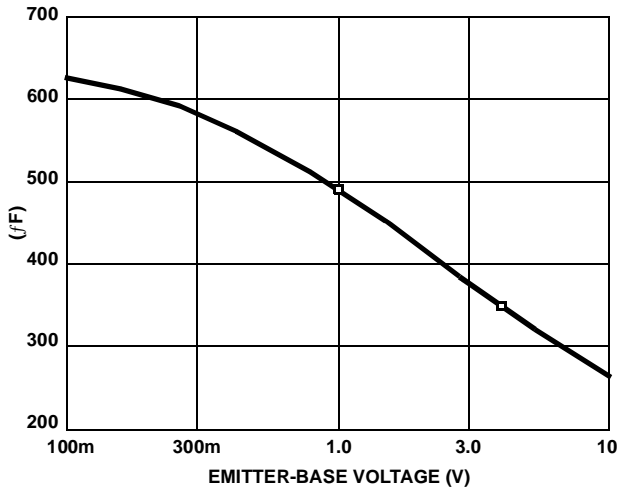
FIGURE 8. CA3127 C$_{EB}$ vs V$_{EB}$
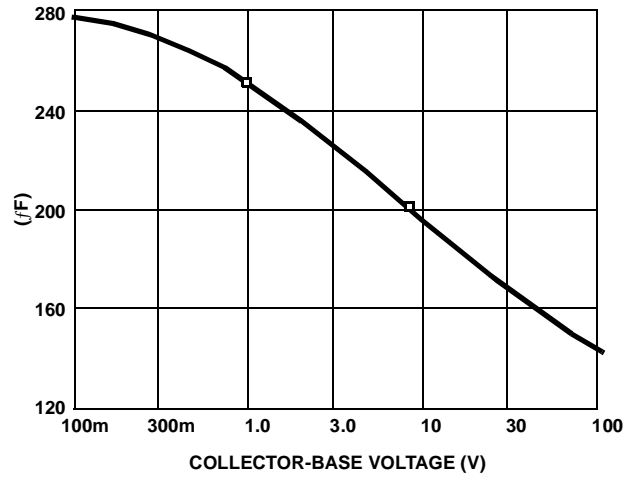
FIGURE 9. CA3127 C$_{CB}$ vs V$_{CB}$
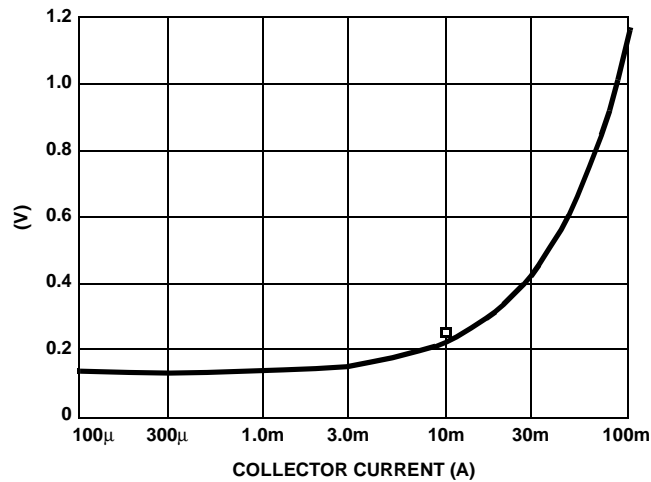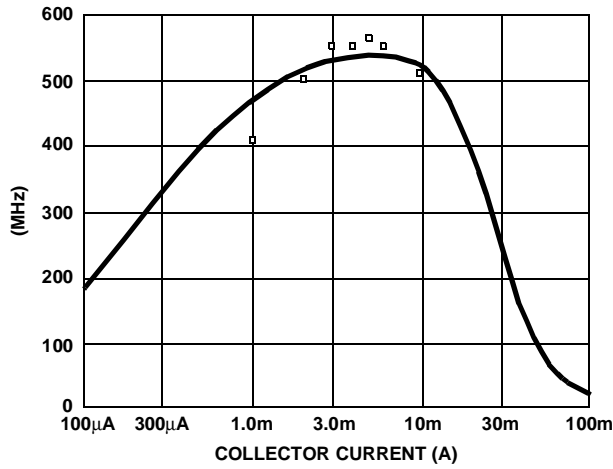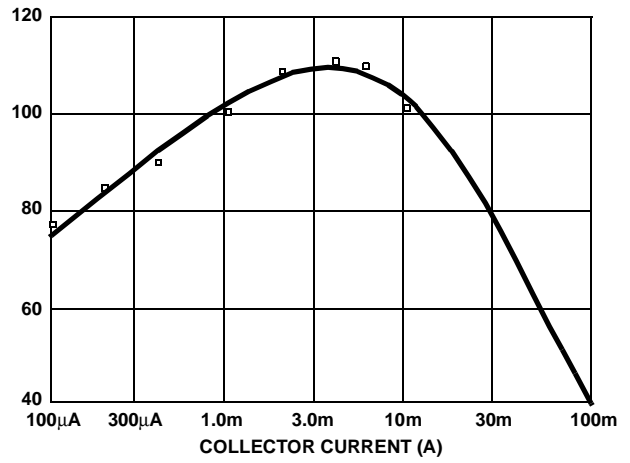

FIGURE 10. CA3127 V$_{CE(SAT)}$ vs I$_C$

CA3086 Model Performance

FIGURE 11. CA3086 f_T vs I_C

FIGURE 12. CA3086 h_{FE} vs I_C
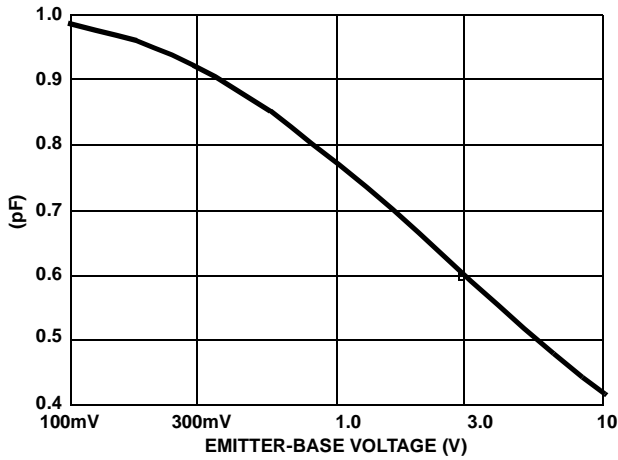
FIGURE 13. CA3086 C_{EB} vs v_{EB}
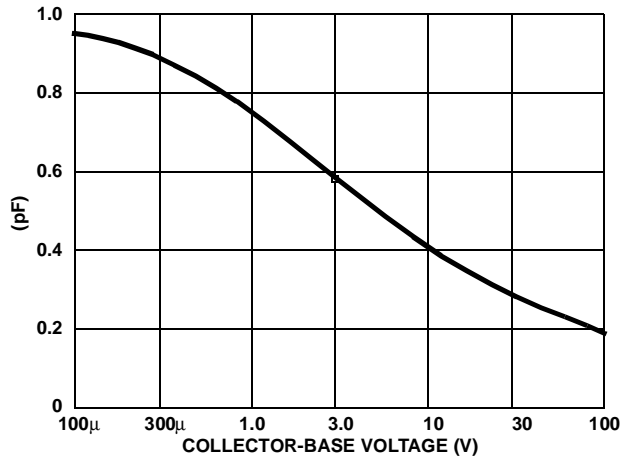
FIGURE 14. CA3086 C_{CB} vs v_{CB}
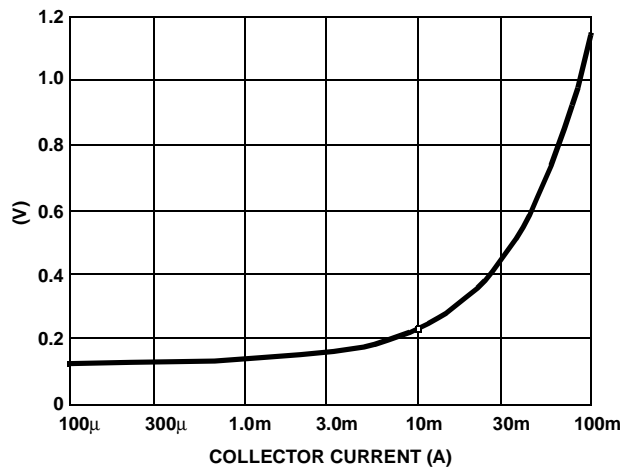
FIGURE 15. CA3086 $v_{CE(SAT)}$ vs I_C

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For information regarding Intersil Corporation and its products, see www.intersil.com

Sales Office Headquarters

NORTH AMERICA
Intersil Corporation
7585 Irvine Center Drive
Suite 100
Irvine, CA 92618
TEL: (949) 341-7000
FAX: (949) 341-7123

Intersil Corporation
2401 Palm Bay Rd.
Palm Bay, FL 32905
TEL: (321) 724-7000
FAX: (321) 724-7946

EUROPE
Intersil Europe Sarl
Ave. C - F Ramuz 43
CH-1009 Pully
Switzerland
TEL: +41 21 7293637
FAX: +41 21 7293684

ASIA
Intersil Corporation
Unit 1804 18/F Guangdong Water Building
83 Austin Road
TST, Kowloon Hong Kong
TEL: +852 2723 6339
FAX: +852 2730 1433