# Monolithic Transistor Array – SiS3045J

**Silicon General Purpose x5 NPN Transistor array in CERDIP-14**

**Rev 1.1**
**20/10/17**

## Description

The SiS3045J consists of five general purpose silicon NPN transistors on a common monolithic substrate. Two of the transistors are internally connected to form a differentially-connected pair. The transistors are well suited to a wide variety of applications in low power systems in the DC through VHF range. They may be used as discrete transistors in conventional circuits however; in addition, they provide the very significant inherent integrated circuit advantages of close electrical and thermal matching. The SiS3045J is a direct electrical & mechanical replacement for the obsolete National Semiconductor LM3045J.

## Features:

- Two matched transistors:
  - $V_{BE}$ Match ±5mA
  - $I_{IO}$ Match 2µA (Max).
- Low Noise Figure 3.2dB (Typ) at 1kHz
- Operation From DC to 120MHz
- Wide Operating Current Range
- Full Military Temperature Range.

## Ordering Information

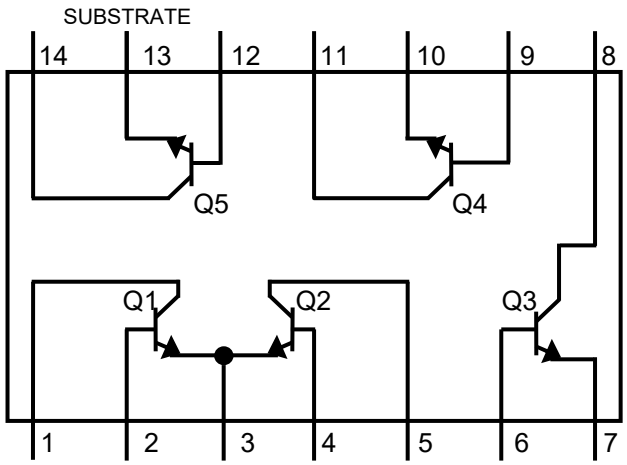
The following part suffixes apply:

**SiS3045J** - 14 Lead Ceramic Dual-In-Line Package

## Applications:

- Three Isolated Transistors and One Differentially Connected Transistor Pair for Low Power Applications at Frequencies from DC Through the VHF Range
- Custom Designed Differential Amplifiers
- Temperature Compensated Amplifiers.

## Schematic & Connection Diagram




## Absolute Maximum Ratings

| PARAMETER | SYMBOL | VALUE | UNIT |
|---|---|---|---|
| Collector-to-Emitter Voltage | $V_{CEO}$ | 15 | V |
| Collector-to-Base Voltage | $V_{CBO}$ | 20 | V |
| Collector-to-Substrate Voltage (Note 1) | $V_{CIO}$ | 20 | V |
| Emitter-to-Base Voltage | $V_{EBO}$ | 5 | V |
| Collector Current | $I_C$ | 50 | mA |
| Maximum Power Dissipation (Any one transistor) | $P_D$ | 300 | mW |
| Operating Temperature Range | - | -55 to 125 | °C |
| Maximum Junction Temperature | $T_J$ | 175 | °C |

## DC Electrical Characteristics $T_A$ = 25°C unless otherwise stated

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Collector to Base Breakdown Voltage | $V_{(BR)CBO}$ | $I_C$ = 10µA, $I_E$= 0 | | 20 | 60 | - | V |
| Collector to Emitter Breakdown Voltage | $V_{(BR)CEO}$ | $I_C$ = 1mA, $I_B$ = 0 | | 15 | 24 | - | V |
| Collector-to-Substrate Breakdown Voltage | $V_{(BR)CIO}$ | $I_C$ = 10µA, $I_{CI}$ = 0 | | 20 | 60 | - | V |
| Emitter to Base Breakdown Voltage | $V_{(BR)EBO}$ | $I_E$ = 10µA, $I_C$= 0 | | 5 | 7 | - | V |
| Collector Cutoff Current | $I_{CBO}$ | $V_{CB}$ = 10V, $I_E$ = 0 | | - | 0.002 | 40 | nA |
| Collector Cutoff Current (Figure 2) | $I_{CEO}$ | $V_{CE}$ = 10V, $I_B$ = 0 | | - | FIG 2 | 0.5 | µA |
| Forward Current Transfer Ratio (Static Beta) (Note 3) (Figure 3) | $h_{FE}$ | $V_{CE}$ =3V | $I_C$ = 10mA | - | 100 | - | - |
| | | | $I_C$ = 1mA | 40 | 100 | - | - |
| | | | $I_C$ = 10µA | - | 54 | - | - |
| Input Offset Current for Matched Pair Q1 and Q2. (Note 2) (Figure 4) | $\lvert I_{IO1} - I_{IO2} \rvert$ | $V_{CE}$ = 3V, $I_C$ = 1mA | | - | 0.3 | 2 | µA |
| Base-to-Emitter Voltage (Note 2) (Figure 5) | $V_{BE}$ | $V_{CE}$ = 3V | $I_E$ = 1mA | - | 0.715 | - | V |
| | | | $I_E$ =10mA | - | 0.800 | - | |
| Magnitude of Input Offset Voltage for Differential Pair (Note 2) (Figures 5, 7) | $\lvert V_{BE1} - V_{BE2} \rvert$ | $V_{CE}$ = 3V, $I_C$ = 1mA | | - | 0.45 | 5 | mV |
| Magnitude of Input Offset Voltage for Isolated Transistors. (Note 2) (Figures 5, 7) | $\lvert V_{BE3} - V_{BE4} \rvert$<br>$\lvert V_{BE4} - V_{BE5} \rvert$<br>$\lvert V_{BE5} - V_{BE3} \rvert$ | $V_{CE}$ = 3V, $I_C$ = 1mA | | - | 0.45 | 5 | mV |
| Temperature Coefficient of Base-to-Emitter Voltage (Figure 6) | $\frac{\Delta V_{BE}}{\Delta T}$ | $V_{CE}$ = 3V, $I_C$ = 1mA | | - | -1.9 | - | mV/°C |
| Collector-to-Emitter Saturation Voltage | $V_{CES}$ | $I_B$ = 1mA, $I_C$ = 10mA | | - | 0.23 | - | V |
| Temperature Coefficient: Magnitude of Input Offset Voltage (Figure 7) | $\frac{\lvert \Delta V_{IO} \rvert}{\Delta T}$ | $V_{CE}$ = 3V, $I_C$ = 1mA | | - | 1.1 | - | µV/°C |

## Dynamic Electrical Characteristics $T_A$ = 25°C unless otherwise stated

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Low Frequency Noise Figure (Figure 9) | NF | f = 1 kHz, $V_{CE}$ = 3V<br>$I_C$ = 100µA, Source Resistance = 1kΩ | - | 3.25 | - | dB |
| **Low Frequency, Small Signal Equivalent Circuit Characteristics** | | | | | | |
| Forward Current Transfer Ratio (Figure 11) | $h_{FE}$ | f = 1 kHz<br>$V_{CE}$ = 3V, $I_C$ = 1mA | - | 110 | - | - |
| Short Circuit Input Impedance (Figure 11) | $h_{IE}$ | f = 1 kHz<br>$V_{CE}$ = 3V, $I_C$ = 1mA | - | 3.5 | - | kΩ |
| Open Circuit Output Impedance (Figure 11) | $h_{OE}$ | f = 1 kHz<br>$V_{CE}$ = 3V, $I_C$ = 1mA | - | 15.6 | - | µmho |
| Open Circuit Reverse Voltage Transfer Ratio (Figure 11) | $h_{RE}$ | f = 1 kHz<br>$V_{CE}$ = 3V, $I_C$ = 1mA | - | $1.8 \times 10^{-4}$ | - | - |

## Dynamic Electrical Characteristics continued $T_A$ = 25°C unless otherwise stated

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| **Admittance Characteristics** | | | | | | |
| Forward Transfer Admittance (Figure 12) | $Y_{FE}$ | f = 1 kHz<br>$V_{CE}$ = 3V, $I_C$ = 1mA | - | 31 - j1.5 | - | - |
| Input Admittance (Figure 13) | $Y_{IE}$ | f = 1 kHz<br>$V_{CE}$ = 3V, $I_C$ = 1mA | - | 0.3 + j0.04 | - | - |
| Output Admittance (Figure 14) | $Y_{OE}$ | f = 1 kHz<br>$V_{CE}$ = 3V, $I_C$ = 1mA | - | 0.001+j0.03 | - | - |
| Reverse Transfer Admittance (Figure 15) | $Y_{RE}$ | f = 1 kHz<br>$V_{CE}$ = 3V, $I_C$ = 1mA | - | Fig 14 | - | - |
| Gain Bandwidth Product (Figure 16) | $f_T$ | $V_{CE}$ = 3V, $I_C$ = 1mA | 300 | 550 | - | MHz |
| Emitter-to-Base Capacitance | $C_{EB}$ | $V_{EB}$ = 3V, $I_E$ = 0 | - | 0.6 | - | pF |
| Collector-to-Base Capacitance | $C_{CB}$ | $V_{CB}$ = 3V, $I_C$ = 0 | - | 0.58 | - | pF |
| Collector-to-Substrate Capacitance | $C_{CI}$ | $V_{CS}$ = 3V, $I_C$ = 0 | - | 2.8 | - | pF |

Notes: **1.** Each transistor collector is isolated from the substrate by an integral diode. The substrate (Pin 13) must be connected to the most negative point in the external circuit to maintain isolation between transistors & normal transistor action. **2.** Actual forcing current is via the emitter for this test.

## Typical Performance Characteristics

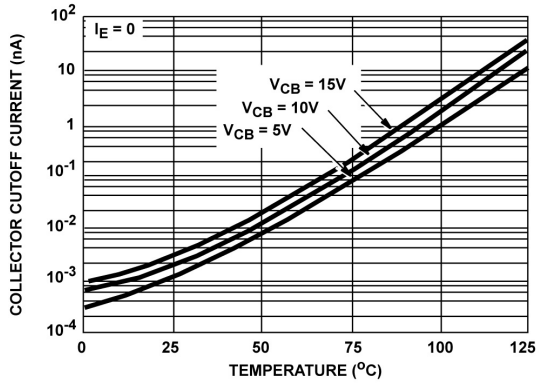



**FIGURE 1.** Base-To-Collector Current vs Temperature

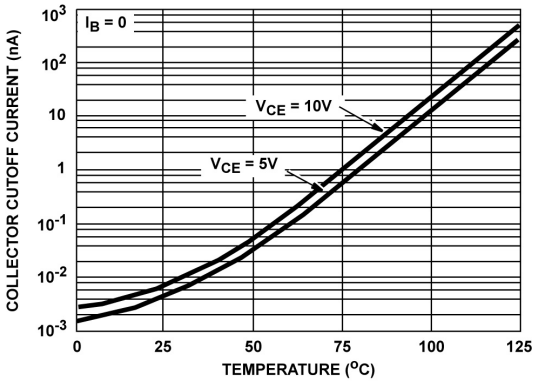



**FIGURE 2.** Collector-To-Emitter Cutoff Current vs Temperature

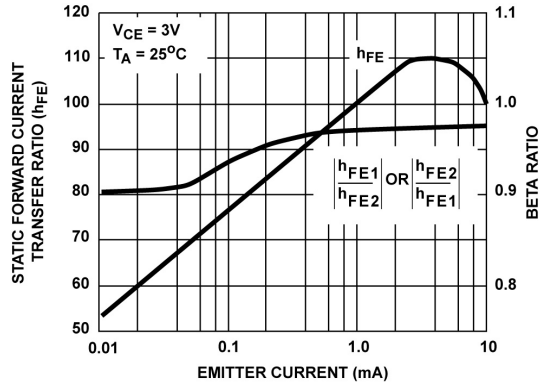



**FIGURE 3.** Static Forward Current Transfer Ratio & Beta Ratio for $Q_1$ and $Q_2$ vs Emitter Current

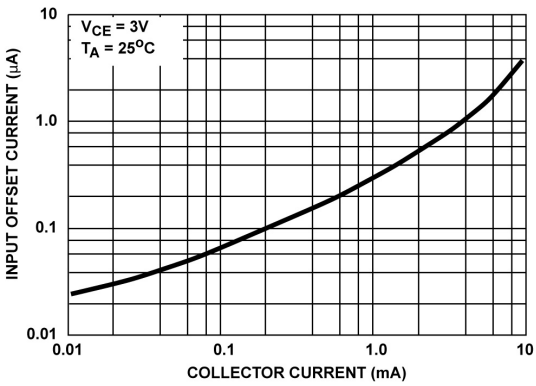



**FIGURE 4.** Input Offset Current for matched transistor pair $Q_1Q_2$ vs Collector Current

## Typical Performance Characteristics (Continued)

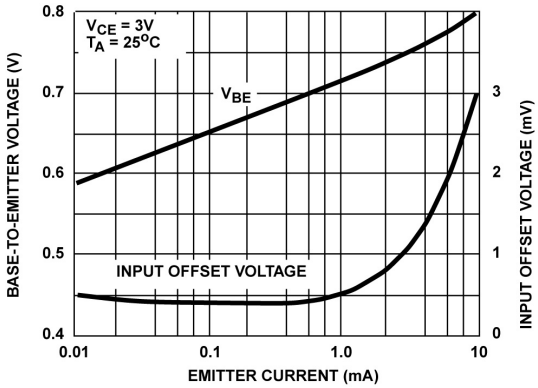



**FIGURE 5.** Static Base-to-Emitter Voltage characteristics and Input Offset Voltage for differential pair and paired isolated transistors vs Emitter Current

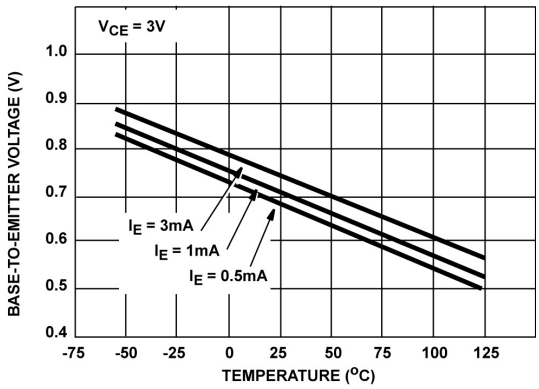



**FIGURE 6.** Base-to-Emitter Voltage characteristic vs Temperature for each transistor.

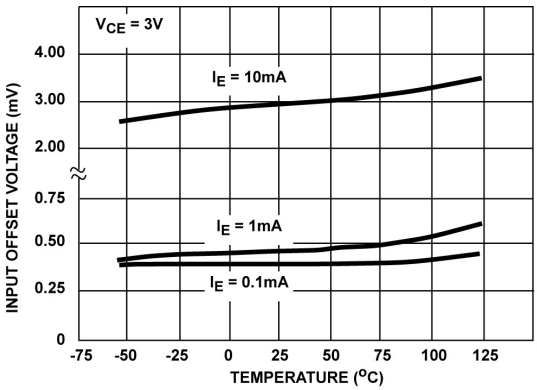



**FIGURE 7.** Input Offset Voltage characteristics for differential pair and paired isolated transistors vs Temperature

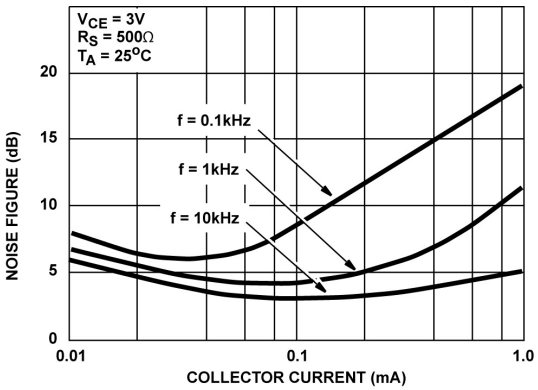



**FIGURE 8.** Noise Figure vs Collector Current

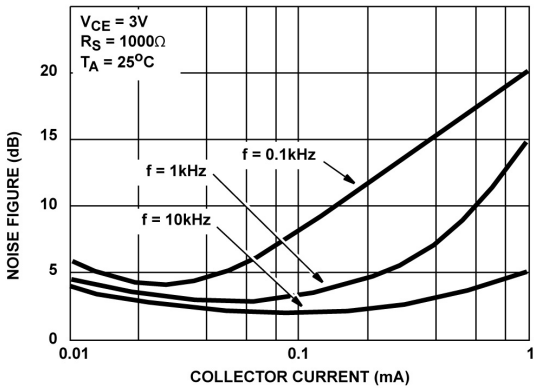



**FIGURE 9.** Noise Figure vs Collector Current

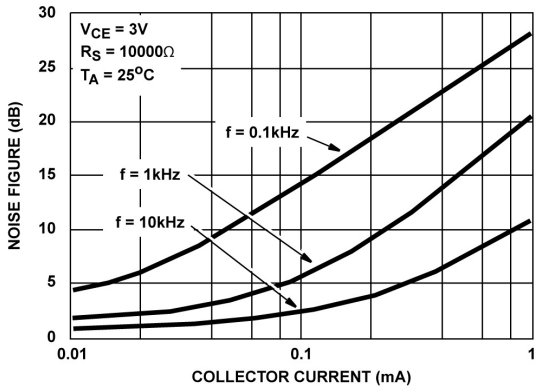



**FIGURE 10.** Noise Figure vs Collector Current

## Typical Performance Characteristics (Continued)

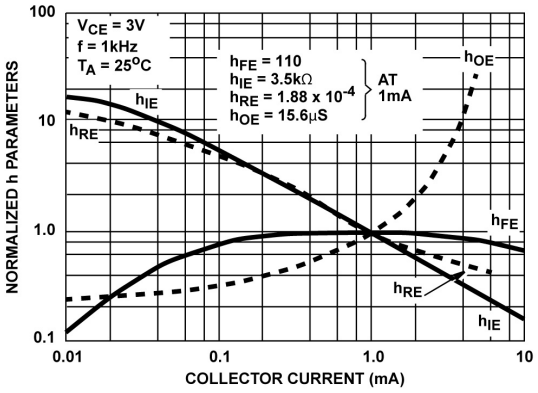



**FIGURE 11.** Normalized Forward Current Transfer ratio, Short Circuit Input Impedance, Open Circuit Output Impedance, And Open Circuit Reverse Voltage Transfer Ratio vs Collector Current

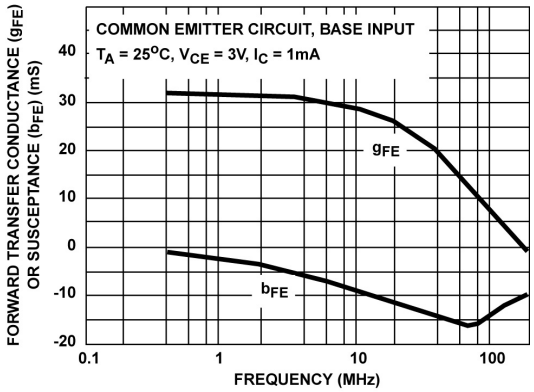



**FIGURE 12.** Forward Transfer Admittance vs Frequency

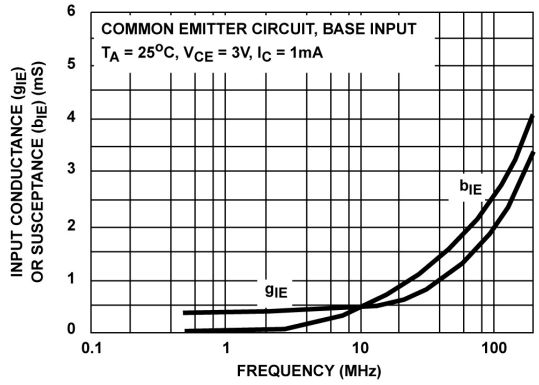



**FIGURE 13.** Input Admittance vs Frequency

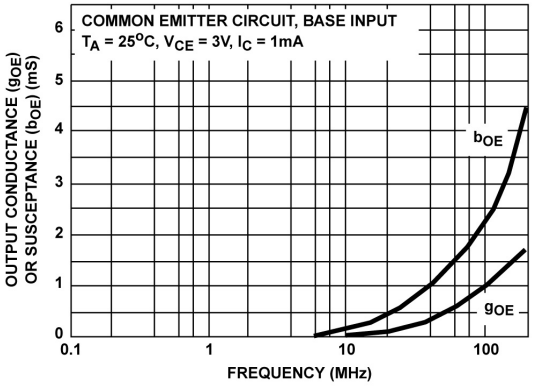



**FIGURE 14.** Output Admittance vs Frequency

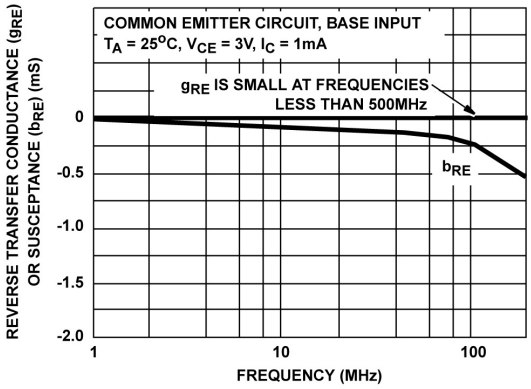



**FIGURE 15.** Typical Reverse Transfer Admittance vs Frequency

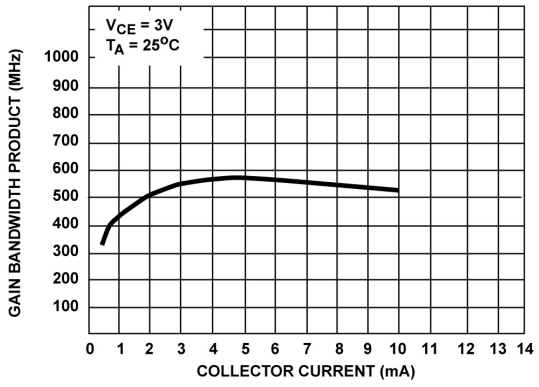



**FIGURE 16.** Typical Gain Bandwidth Product vs Collector Current

**Rev 1.1**
**20/10/17**

## Ceramic Dual-In-Line - Package Dimensions and Footprint