900MHz Down Converter Consumes Little Power (HFA3101)

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Most 900MHz down converter designs are proprietary and, thus, are unavailable to the industry. The designs that are available are usually discrete or require high voltage, which excludes them from the portable market. The down converter in Figure 1 is nonproprietary and suits battery powered applications. Moreover, you can use the IC manufacturer's PC board artwork to get a head start.

The heart of the down converter is a Gilbert cell, which consists of two long-tailed, differential-amplifier stages connected as two variable transconductance amplifiers. Because the cell is constructed from the HFA3101 transistor array, the differential amplifier stages are inherently matched. The inherent matching also reduces distortion resulting from thermal effects and mismatches in transistor beta and ohmic resistances. With the HFA3101 configured as shown, each pair of bases acts as a multiplier input. Thus, if you connect a local oscillator and an RF signal to the two inputs, the circuit generates the sum and difference frequency for the down conversion.

R_1, R_2, and R_3 form a voltage bias network to bias the longtailed pairs; the circuit holds the bases of the current source, Q_5, and Q_6, at 1V and the bases of the inputs, Q_1 and Q_4, at 2.5V. Setting R_E at 27Ω yields emitter currents of approximately 5.5mA, which is adequate to achieve the required bandwidth. This value of R_E is high enough so the quantity βR_E does not load the RF signal source. R_{B1} and R_{B2} terminate the transistor bases with 50Ω through the 0.01μF decoupling capacitors, so the capacitors should be of high quality.

All the components should be leadless, with self-resonant frequencies exceeding 1GHz. The output matching circuit comprising L_C, C_C, and R_C maximizes the gain. The selection of these components maximizes gain while allowing a 50Ω termination; the tuned, medium-Q matching network yields a 50Ω to 2kΩ transformation.

With the component values and frequencies in Figure 1, the circuit down converts 900MHz to 75MHz by using an 825MHz local oscillator signal, and it does so with 50Ω terminations. The circuit functions with supplies lower than 3V and draws comparatively low current for a down converter of this frequency. Thus, it's well suited for battery powered systems. You can obtain the PC board artwork from the HFA3101 data sheet; you need no permission from Intersil Corporation to use the pattern.

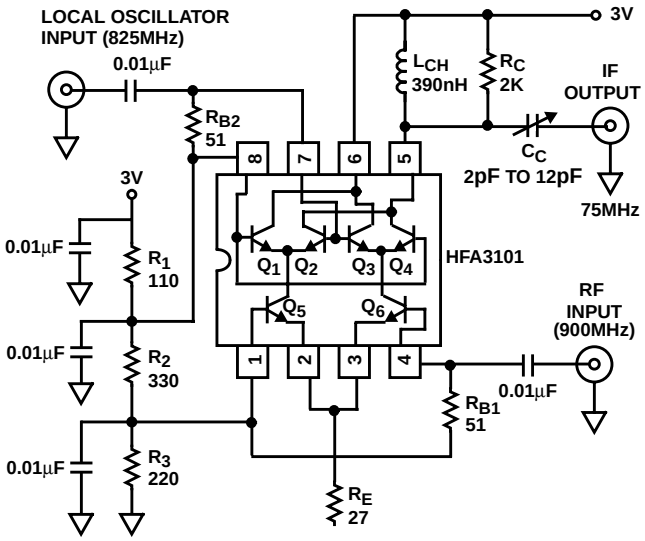

FIGURE 1. 3V DOWN CONVERTER APPLICATION

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