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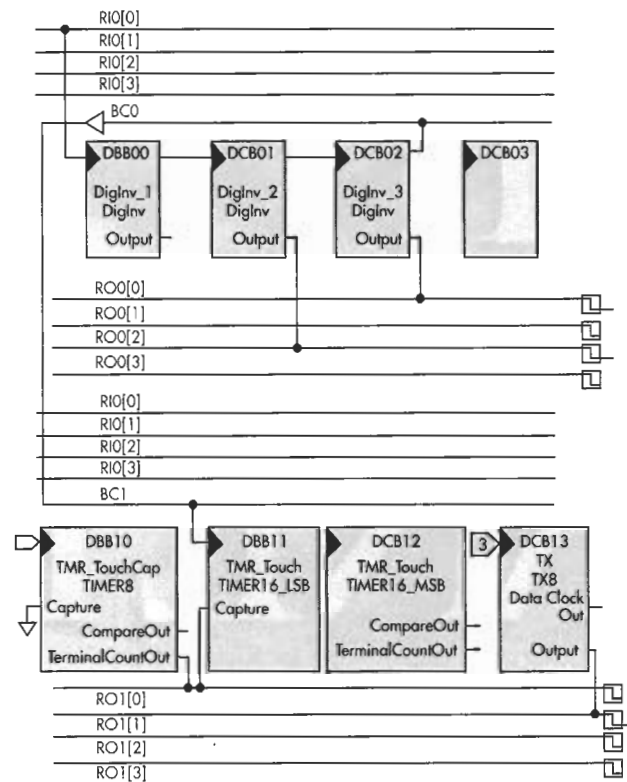
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Proximity-Sensing Intercom Uses Standard Programmable SoC

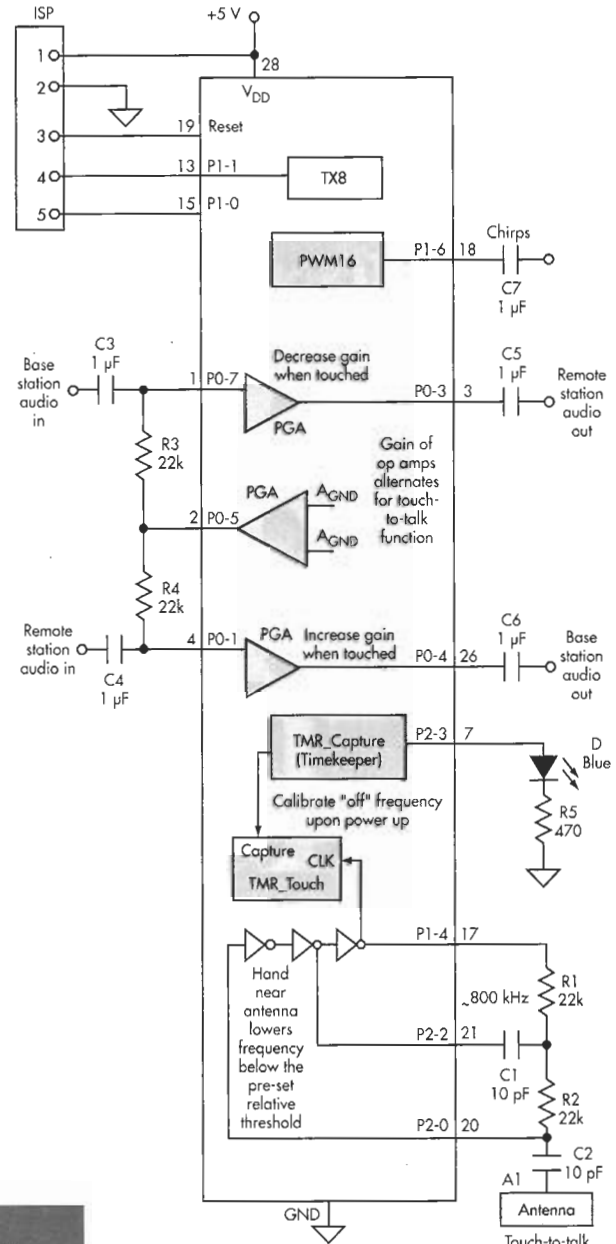
Designers can use specialized ICs as a simple way to add touch-sensing capabilities to a circuit. For instance, the Cypress CapSense devices can handle several touch buttons and a touch slider. In some designs, however, one button might suffice. One example is a “touch-to-talk” intercom application.

In this case, a mixed-signal programmable system-on-a-chip (PSoC) will do. The PSoC has digital blocks that can be configured as a sensitive proximity detector and analog blocks that form programmable audio channels. With the addition of microphones and audio amplification, this single chip forms a complete intercom—with many blocks left over for additional functions.

The design described here uses a CY8C29466, which is a more robust PSoC with additional memory and digital function blocks. This allows room for the touch-sensing modules—a 16-bit pulse-



1. This digital block configuration for the proximity-sensing intercom (except the TX module) was created using PSoC Designer from Cypress Semiconductor.



2. The proximity-sensing intercom includes a PWM module that provides different chirps to indicate power-up, calibration completion, detection of a hand, and removal of a hand.



CHRIS PAIANO, a software engineer and owner of CpE, holds a BS in computer engineering from the University of Central Florida, Orlando. He has written more than 30 application notes for the Cypress PSoC microcontroller, and is working on several alternative energy projects.

width modulator (PWM) for audio feedback and a serial TX module for a terminal display. However, the design can easily fit into a less-expensive CY8C27443 if the TX module is removed and the digital blocks are rearranged (Fig. 1).

A three-stage ring oscillator, using an RC network with the input capacitor plate exposed, will change frequency when a hand approaches (Fig. 2). This frequency is divided and timed by digital blocks, and it's calibrated by a routine at power-up.

The gain of the continuous-time op amps is used to alternate the talk and listen channels. For simplicity, this version doesn't implement automatic gain control, but it could be added without more components.

The PWM module indicates function with audio chirps through the default channel. Different chirps are sounded on power-up, when the calibration is complete, when a hand is detected, and when removing a hand.

The three digital inverter modules linked in series create a natural transport-delay

oscillator, which is sensitive to the capacitance changes introduced by a human hand nearing its antenna. The timer modules work together to measure the period of this oscillation.

This is all possible with a standard PSoC chip. The user modules and inherent flexibility of this IC provide more than enough resources to achieve this, with room left over for expansion.

An excerpt from the C code is available at www.electronicdesign.com. Basically speaking, the excerpt is the meat of the touch sensing logic (the "mHandleTouchSensing" macro, called once per main loop). The C code will determine whether or not a hand is present based on these timer readings.

To obtain a full description of the project and source files, go to www.cpeproto.com, click on the "Development" dropdown menu button, and then click on "ED - Ideas For Design." This intercom is listed as "Simple PSoC Touch-Sensing Intercom (IFD2344)."