Each Pixel of a Four-Color Focal-Plane Array would be divided into four subpixels containing stacked photodetectors for four wavelength bands. The pixels would be identical except for the electrical connections for activating the detectors for different wavelength-band combinations.
The dopant and its concentration are chosen to optimize the performance of the bolometer, taking account of the bolometer operating temperature, the temperature of the source of infrared radiation to be detected, and other relevant environmental factors.

An important practical advantage of the use of silicon, in contradistinction to other semiconductors, is that the art of fabrication of electronic devices from silicon is mature, enabling mass production at low cost per device. An additional advantage accrues when indium is used as the dopant: Indium can be incorporated into silicon over a wide range of concentrations with little consequent change in the basic structure of the silicon matrix. Hence, with impunity, the concentration of indium dopant can be set at almost any desired value in an effort to obtain the desired electrical impedance.

This work was done by John Goebel and Robert McMurray of Ames Research Center. Further information is contained in a TSP (see page 1).

This invention has been patented by NASA (U.S. Patent No. 6,838,669). Inquiries concerning rights for the commercial use of this invention should be addressed to the Ames Technology Partnerships Division at (650) 604-2954. Refer to ARC-14577.

Multichannel X-Band Dielectric-Resonator Oscillator

Unlike other DROs, this one is electrically tunable.

NASA’s Jet Propulsion Laboratory, Pasadena, California

A multichannel dielectric-resonator oscillator (DRO), built as a prototype of a local oscillator for an X-band transmitter or receiver, is capable of being electrically tuned among and within 26 adjacent frequency channels, each 1.16 MHz wide, in a band ranging from ≈7,040 to ≈7,070 GHz. The tunability of this oscillator is what sets it apart from other DROs, making it possible to use mass-produced oscillator units of identical design in diverse X-band applications in which there are requirements to use different fixed frequencies or to switch among frequency channels.

The oscillator (see figure) includes a custom-designed voltage-controlled-oscillator (VCO) monolithic microwave integrated circuit (MMIC), a dielectric resonator disk (“puck”), and two varactor-coupling circuits, all laid out on a 25-mil (0.635-mm)-thick alumina substrate having a length and width of 17.8 mm. The resonator disk has a diameter of 8.89 mm and a thickness of 4.01 mm. The oscillator is mounted in an 8.9-mm-deep cavity in a metal housing.

The VCO MMIC incorporates a negative-resistance oscillator amplifier along with a buffer amplifier. The resonator disk is coupled to a microstrip transmission line connected to the negative-resistance port of the VCO MMIC. The two varactor-coupling circuits include microstrip lines, laid out orthogonally to each other, for coupling with the resonator disk. Each varactor microstrip line is DC-coupled to an external port via a microwave choke. One varactor is used for coarse tuning to select a channel; the other varactor is used (1) for fine tuning across the 1.16-MHz width of each channel and (2) as a feedback port for a phase-lock loop. The resonator disk is positioned to obtain (1) the most desir-