Electronics international

West Germany

Thick-film ceramic matrix is programable

A programable matrix element just out of the labs of Microelectronic, a small components maker in southern Germany, handles high power levels yet owes its compactness to thick-film fabrication techniques.

Dubbed Micro-Matrix, the new element, because of its programability, is especially well suited as a customized data input device for various types of electronic equipment. It consists essentially of two levels of conductors sandwiched between ceramic insulating layers. Because the conducting paths in one level are arranged at right angles to those in the other level, the device constitutes an array of ohmic crosspoints. To program this matrix a current is sent through a crosspoint so that the connection between the upper and the corresponding lower path is severed.

Andreas Lewicki, head of Microelectronic, says it's the first time that a fixed memory matrix based on thick-film techniques has been made. The Micro-Matrix will hit the market shortly and is expected to sell for between $5 and $250 depending on lot size and number of inputs and outputs.

The new device is aimed for use in environments where shock, vibration, corrosive atmospheres, and abrupt temperature changes would normally cause contact or transfer resistance variations in conventional crossbar distributors or similar systems. Specifically, it is intended as a fixed program input device for test and measuring equipment, for analog computers, and for electronic gear used in control engineering applications.

Microelectronic's new component is no match for conventional monolithic diode matrices as far as size is concerned. But this drawback is balanced by several significant advantages. For one thing, the Micro-Matrix has linear ampere-volt characteristics and can handle ac power from zero hertz through line and audio frequencies to radio frequencies because of its low stray capacitance and inductance. And since it is independent of pulse polarity, it works with digital circuits with both positive and negative pulses. Because of high dielectric isolation between inputs and outputs, the current is zero even when several hundred volts are across an open crosspoint at ambient temperatures of several hundred degrees centigrade. Shorted crosspoints can handle several amperes and up to 500 volts.

Fabricating the matrix starts out with a ceramic substrate, which for a typical device may measure 1 inch on a side and 0.025 inch thick. In a screen printing process using a noble-metal conducting paste, parallel lines spaced 0.05 in. apart are printed onto the substrate. The paste is dried in an infrared oven and sintered at between 900° and 1,000°C in a conveyor belt furnace. The conductors are covered with perpendicular ceramic strips. In similar screen printing, drying and sintering steps, parallel conductors are deposited on top of the ceramic strip—two per strip.

A typical 1-by-1-in. device has 18 conductors on each level, for a total of 324 crosspoints. Electrical connection at each point is made by means of screen-printed auxiliary electrodes and conducting bars, which compensate for any errors that might occur during alignment procedures.

For programing the Micro-Matrix, unwanted crosspoint connections are burnt through by applying a current of between 2 and 10 amperes, depending on the power-handling capacity of the device. In the burnout process, the higher resistance of the connecting bars insures that the connection is severed at the proper spot.

Programing is generally handled by the customer himself, but when large quantities of devices with the same program structure are involved, programing can be done at the supplier's facility. In this case programing is done with printing masks having a special connecting-bar pattern.

Without altering the fabrication steps, resistance matrices can be manufactured by simply using resistive instead of conductive pastes for making the crosspoints.