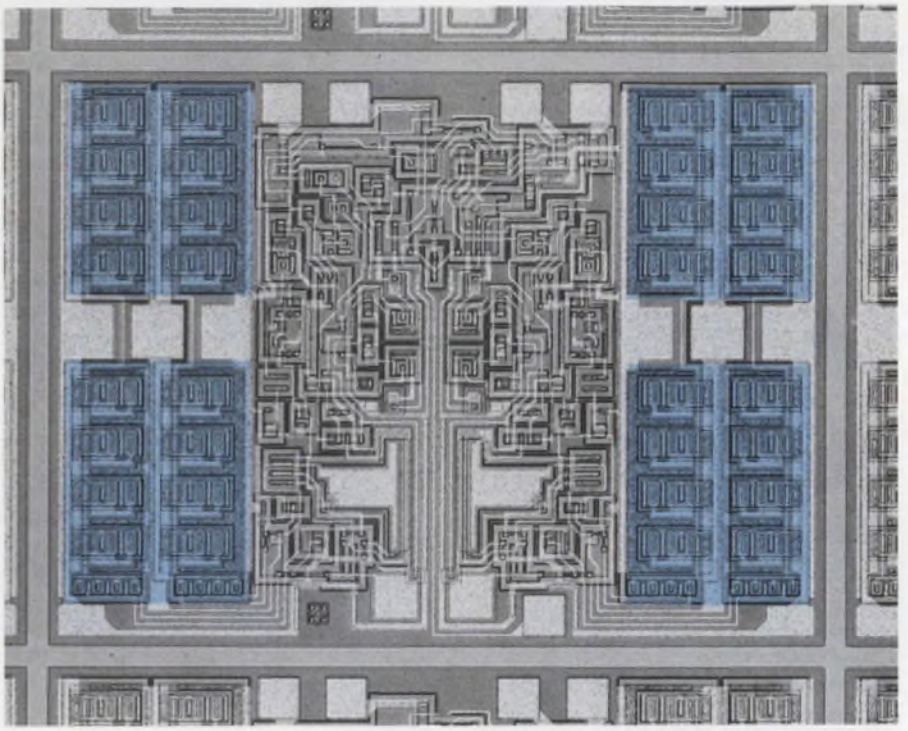
news

Quad-linear ICs racing up the pike, paced by automotive applications

Quad-linear ICs, spawned by the special needs of the automotive industry for low-cost, highly reliable electronic devices, are rapidly becoming popular not only among linear-circuit designers but among digital as well.

These four-in-one circuits—be they op amps, comparators or Norton amplifiers—are being used in increasing quantities in antiskid, fuel-injection and emission-control circuits, all of which require low-power, dependable ICs. One industry source has estimated that the automotive market for quads will reach 10-million a month after next March.

The first quad-linear circuits appeared on the market about a year and a half ago. In May of 1972 both Motorola Semiconductor in Phoenix, Ariz., and National Semiconductor, Santa Clara, Calif., introduced quad-current amplifier circuits—the MC3401 and LM-3900, respectively.



The National Semiconductor LM3900 quad amplifier which can operate off a single-power supply of 4 to 36 VDC, features four independent internally compensated amplifiers.

Benefits to the designer

Quad-linear devices offer a number of benefits to the circuit designer. First, the tendency is for the quad circuit to be cheaper than a combination of single or dual circuits. One quad takes less PC-board space than two duals or four singles—and a reduction in board size means easier mounting, lighter mounting structure and an overall reduction in the weight of a product. In addition, for many linear-circuit applications, quads allow the use of shorter signal leads—thereby reducing stray capacitance, excessive capacitance or inductive coupling and propagation delays.

An important cost saving over duals and singles comes from a reduction in the number of IC insertions in a board. The cost of inserting and connecting any package into a board varies from company to company; often the cost of a part is overshadowed by the labor cost of installation.

A less obvious cost saving comes from the reduced repair, rework and revision needed on boards designed intelligently with quad-linear circuits. A linear circuit is more likely to fail in service than a digital circuit. It must amplify analog signals over a variety of operating conditions, temperatures and signal situations, and any aberation can be disastrous to circuit operation. If the technician can replace the active circuitry of a whole section of a board with a single package, it can mean a very real saving in maintenance cost.

Some design engineers say they are seriously considering using three of four amplifiers in a quad package and leaving one as an installed spare. Their reasoning is that in a monolithic quad circuit the unused spare will be subjected to the same temperatures and stresses as the three active circuits —so the repair technician has a pre-aged replacement already on the circuit board. After switching in the good amplifier, the circuit should require a minimum of

Northe K. Osbrink
Western Editor

tweaking to perform properly, these designers say.

Today the circuit designer has a reasonable selection of quad-linear circuits to choose from. The initial offering of the MC3401 and LM3900 is still available and either has or is about to be second-sourced by RCA, Fairchild Semiconductor, Raytheon and Signetics. Today there is a further op-amp choice—the 4136 from Raytheon Semiconductor of Mountain View, Calif. It is a monolithic quad 741 high-gain voltage amplifier requiring a plus and minus power supply. Texas Instruments also has a quad 741, a two-chip version operating from a plus and minus supply.

Another unit available is the National Semiconductor LM324. It operates from one power supply of from 3 to 30 V dc, or can be operated on dual supplies.

A designer requiring a quad comparator is limited to the LM-3901, introduced by National Semiconductor and now second-sourced by Motorola. Additional components in the quad configuration include the quad opto-isolator, introduced in August by Litronix of Cupertino, Calif.; a number of quad epitaxial planar silicon transistors available from Texas Instruments, Dallas, and such devices as quad line driver-receivers from Signetics, Sunnyvale, Calif.

National Semiconductor's marketing manager for linear products, Art Fury, sees a strong future for the quad industry.

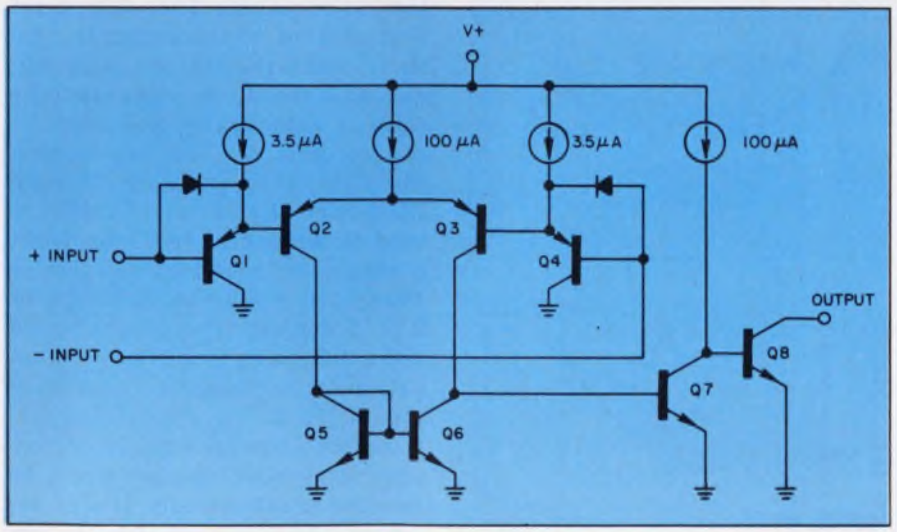
"Engineers are beginning to realize that quad-linear circuits can be building blocks," he says. "By adding a few external components, the quads can become function generators, active filters or signal-processing circuits."

These building-block circuits can be cheap and easy to design. As an example, Fury says, "a quad op amp can be made into a very nice, inexpensive function generator—not a Wavetek lab-quality unit but good enough to build into a piece of equipment for self-testing."

National will introduce about six new quad-linear circuits by the end of the year, and both Raytheon and Motorola have circuits in the works. Quad is a magic number for the linear manufacturer since four op amps, comparators or other linear circuits fit nicely into a 14 to 20-pin DIP.

Most manufacturers agree that the quad costs about the same per package as single or dual circuits. Orlando Gallegos, operations manager for Raytheon Semiconductor, says:

"Our monolithic quad op-amp chips have a rejection rate only about 10% higher than a single amplifier chip. When our lines are all handling three-inch wafers, we will be able to build any quad circuits for less than two duals." ■■



Unlike most comparators, the LM 139 can operate from a single power supply and still have an input common mode voltage range that includes ground. It is compatible with all forms of logic and has a power dissipation ranging from 570 mW to 900 mW, depending on the package.