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1976 Award for Achievement

ROBERT C. DOBKIN

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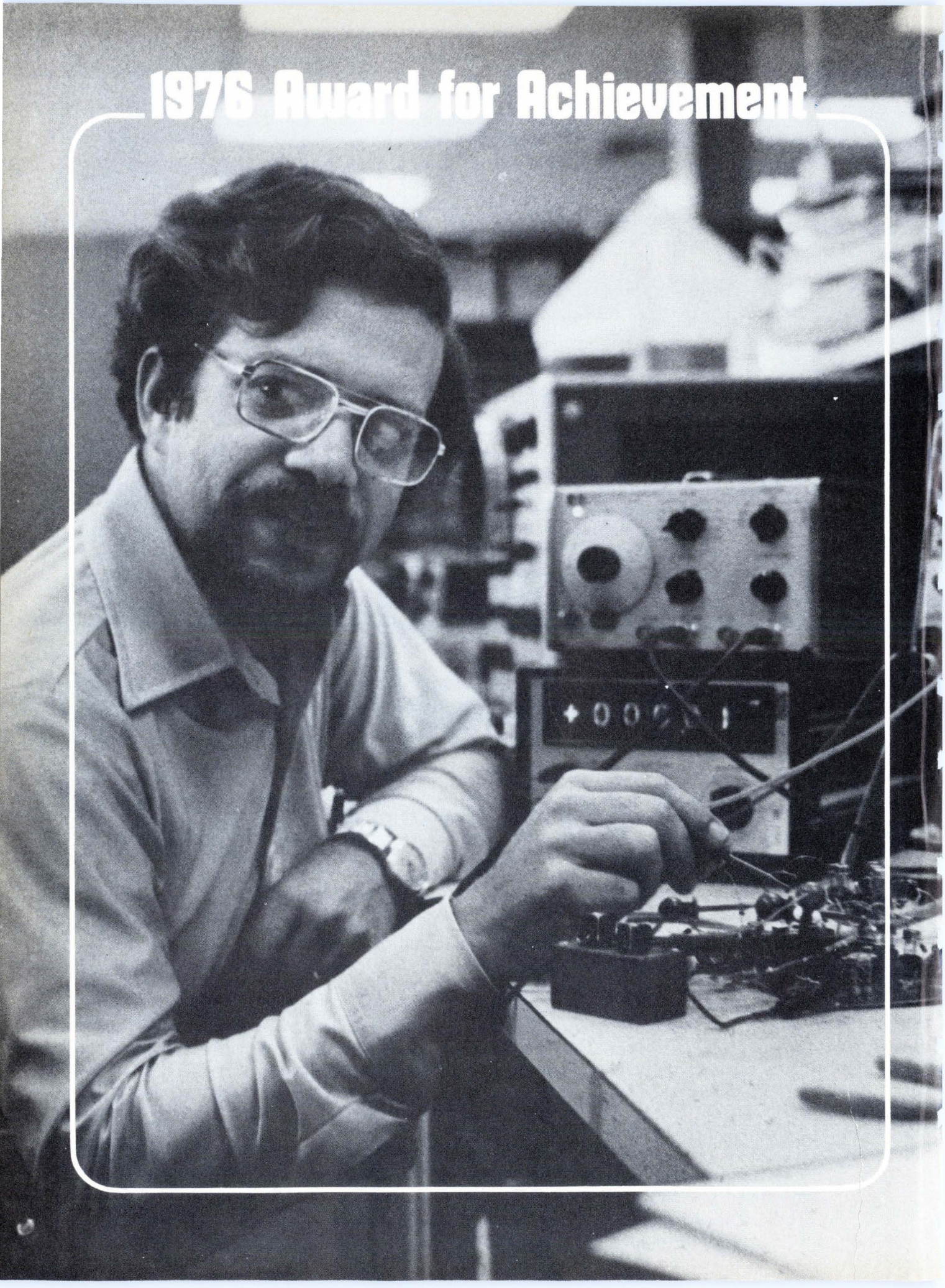

National's Dobkin cited for his linear wizardry

In a world increasingly dominated by microprocessors and other digital large-scale-integrated circuits, it takes an exceptionally creative designer to make waves in the less glamorous linear domain. Yet, over the past ten years, just such waves have come from Robert C. Dobkin, a self-taught 33-year-old engineer and circuit designer who dropped out of the Massachusetts Institute of Technology because he was bored.

He is now director of advanced-linear-product design at National Semiconductor Corp. in Santa Clara, Calif. His 20 patents and patent applications cover circuits and processes fundamental to monolithic linear-circuit design, as well as such diverse areas as transistor-transistor-logic circuits, digital-watch testing, pressure- and temperature-transducer design, and vertical-channel field-effect-transistor fabrication. In concert with his predecessor at National, Robert Widlar, he is responsible for the design of some of the industry's first operational amplifiers and linear circuits incorporating band-gap-referencing techniques.

Dobkin, who has the look of a slightly mellow revolutionary, is of the generation of design engineers who grew up with semiconductor technology. Its intricacies and idiosyncracies have become almost second nature to him. "Bob is more than just a clever linear-circuit designer," says Widlar, now a consultant to National. "He's a damn smart one with an asset a lot of designers lack—a detailed knowledge of the terrain he's working: the silicon."

This knowledge comes quite naturally, for "I've been playing around with electronics since I was six or eight years old," Dobkin says. But after he got his hands on one of his first semiconductor devices in his early teens ("a germanium pnp transistor: the CK722, I think"), he would have nothing more to do with vacuum tubes.

It was not simply a hobbyist's interest in what could be built with these components. It was a fascination with the devices themselves—how they did what they did and how far they could be pushed beyond the capabilities listed on data sheets. "There seemed something almost magical about those chunks of material," he says. "It just amazed the hell out of me that they could do what they did. Of course there was no magic at all after I pushed and poked at them enough."

But his approach to a problem is more than just a push and a poke, according to National's converter-products manager, Brent Welling. "Bob has an almost uncanny capacity to absorb information quickly, digest it, and come up with the essentials needed to solve a particular problem. If he can't get the information he needs from tests on the work table, he'll read everything he can get his hands on. If that's not enough, he'll corner anyone he thinks has information he needs. Then he'll go back to pushing and poking at the problem until he has an answer—the answer."

While this ag-

The 1976 Achievement Award

For significant contributions to linear-circuit development, the editors of *Electronics* have voted Robert C. Dobkin, head of advanced linear design at National Semiconductor Corp., the recipient of the magazine's 1976 Achievement Award. At National, he has guided a small group of designers to an impressive string of successful linear-product designs that encompass both circuit and process innovations. Their achievements include the LM120, the industry's first three-terminal voltage regulator; the LM123, the industry's first high-current-output three-terminal regulator; the LM117, the industry's first adjustable three-terminal regulator, and the LM195, the industry's first integrated-circuit power-transistor amplifier. Previous winners of the award were Gordon E. Moore, Intel Corp., in 1974, and for 1975, Arie Slob and Cornelius Hart of Philips Gloeilampenfabrieken, along with Horst Berger and Siegfried Wiedmann of IBM.

gressively obstinate approach to solving problems is a key element in Dobkin's present success, it was not conducive to an academic career. In fact, his attitude probably contributed to his departure from MIT in 1963 at the end of his sophomore year. "I left because I was bored," he says. "I was climbing the walls. They just expected me to sit there, take notes, and take tests. I need a productive situation to do my best. So I got out."

After a series of technician jobs he landed a job in 1966 at General Electric Co. in Philadelphia, where he was responsible for evaluating and building test equipment for semiconductor components in space applications. It wasn't exactly either a technician's or a designer's job. "It was sort of in between," he recalls, "amorphous enough to be anything I wanted it to be."

About this time there began to appear some of the first linear IC work by, among others, Widlar at Fairchild Semiconductor and later at National. "The feeling I got about the technology—and that I still have—is that it is wide open," Dobkin says. "There are no hard and fast rules, except the laws of physics. And, if you know those well enough, you can find the loophole in any given situation to allow you to do almost anything you want to. It's completely eclectic. Nothing is ruled out as long as it works."

He was especially interested in operational amplifiers. After tearing up several made by a pioneer in the field, Teledyne Philbrick, Dedham, Mass., he called engineers there and began asking a lot of penetrating questions. After several weeks they stopped answering. "I think they thought he was from a competitor," says Robert Pease, who was a Philbrick engineer then and is now a member of Dobkin's design group. But to his last question in late 1967—"can I have a job?"—the firm said yes, and he went to work as a linear-circuit designer.

"But after a year it was clear that the real action in linear design was elsewhere," he says. About the same time as this realization came a job offer from Widlar at National. It was the culmination of two years of irritating phone calls, Widlar says. "Every now and then I would get these calls from a wild-sounding freak. He was always asking questions. Finally I hired him and told him to go answer his own damned questions."

Starting in 1969, Widlar and Dobkin worked together on a number of linear circuits including the LM111 comparator. They were joint authors of a patent describing the first use of band-gap-referencing techniques in op amps and other linear devices.

Since taking over the advanced-linear-product-development group in 1970, he has kept it "lean and mean," at first working with just one other designer, Carl Nelson. Later he added Peter Lefferts and Pease.

And what has resulted from this small group of designers in the past five years is at least 15 new linear IC families, more than half of which were industry firsts. Many others have become industry standards. At the same time, the small group has kept up a continuous stream of redesigns on older products with ten- to one-hundred-fold improvements in performance. It also has produced process and fabrication improvements that have allowed National to remain the pricing pacesetter in high-volume linear ICs.

"Dobkin is not only one of the most brilliant designers I've worked with, he also has an amazing feel for exactly what the marketplace needs and wants," says his boss, Robert Swanson, director of linear-circuit operations. "On a number of products he's suggested, my marketing people have told me the volume just didn't justify it. Usually I just take a deep breath and tell him to go ahead. So far, his batting average has been pretty good, and I haven't regretted it."

According to Brian Hollins, director of processing for the advanced-linear-products group, Dobkin "has a gut-level understanding for processing and for the limits and capabilities of the silicon," unusually so for a circuit designer. "He'd make a pretty good process guy, if he weren't a circuit designer," he says.

His participation in the various projects ranges from complete engineering responsibility, such as on the LX5600, to working as a coinvestigator as on the zener IC project with Nelson. Just as often his contribution is the right insight at just the right time. "Just when my brain is turning to mush trying to work through a particular problem," Pease says, "Dobkin says something that makes everything crystal-clear."

This ability extends beyond his own group, according to Siegel who says a number of linear hybrid products came from "a few conversations over coffee." Similar conversations with digital-logic designers led to a patent on a Schottky-TTL-clamped circuit using a linear biasing technique—pnp current sources—instead of resistors. On the digital-watch production line, a calibration technique he invented, based on an optical pickup from the light-emitting-diode display, is used to test modules. And an interest in improvements to the power-handling capabilities of field-effect transistors led to a patent on a vertical-channel FET technique.

With his wife Carrie and two dogs, Dobkin makes his home in Hillsborough, Calif., in a slightly run-down, two-story, 9,000-square-foot frame house built in 1884, which the two of them are restoring. From there they embark on their other favorite pastime, collecting antiques. It's more profitable than house restoration, he says. "It's pretty easy once you know more than the experts." □