Raymond DiBugnara

Engineering Fellow, Director of Technology, Consultant
Semiconductor Design/Process/Quality Senior Technologist

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Introduction

Consultant: Skilled in discrete semiconductor product and process design, development, manufacture and applications. Strong in semiconductor physics, package technology, reliability, test and customer relations. My gifts include the ability to solve problems over a wide range of disciplines, and, to develop tools that enable others to get the job done with as little engineering help as possible.

Experience Summary

Director of Technology
Engineering Fellow — Microsemi Lawrence

- Primary "go to" **Technologist** for Microsemi Lawrence on New and Old QPL and commercial product. This includes resolving difficult burn-in and life testing problems, package, chip design and process challenges, critical failure analysis, extreme environment design support, training consultant and all around "Problem Solver".
- Key Applications Engineering Contact for Lawrence and Ennis products. Customers include Military, Aerospace and Deep Space component design applications as well as commercial products. Support detailed extreme thermal analysis operating conditions generating most thermal impedance and stress curves using own models.
- Created **Rad-Hard test program for Lawrence** and authored template for all DLA discrete Rad-Hard specs. This included building a complete test lab located inside University of Massachusetts Radiation Reactor Dome which I made fully temperature and humidity controlled and topped of by installing high-voltage high-current automatic test equipment for pre and post irradiation exposure data recording.
- Designed and had built own custom **ELDRS dual-hemisphere gamma irradiator** for simultaneous 10mRad/s and 100mRad/s exposure for new **JANSR** product line. Created low cost 48-channel power distribution system capable of up to +/- 1200V for irradiator use that was also safely usable by general production staff with a singular design and interface.
- Assisted with redesign of various diode and transistor product to solve a multitude of problems and challenges. These were accomplished almost entirely with models I designed and wrote.
- Was main **POC** (Point-of-Contact) for the **RoHS-SVHC-REACh** "response" and was writing and posting our detailed declaration (with many package links) on the web site I managed, which, as the REACh count continued increasing, had to be updated on many occasions. I was the first to adopt the "e3" suffix designation for RoHS compliant product which was then adopted by our distributors.

Director of Technology — Sensitron Semiconductor

- Designed and influenced a broad range of product including power **Schottky** rectifiers, **TVS** Transient Voltage Suppressors, 4ns micro diodes, **PIN** diodes, high speed data line I/O suppressors, Radiation Hardened voltage regulators, arrays and assemblies.
- Programs included **JAN1N6638US** total development including modeling, mask designs**, all waferfab processes**, passivation, lifetime doping processes and self-brazing die-slug metallization. In addition, I developed that **glass-to-metal voidless package** design, documented and specified and purchased all piece part components, loading fixtures, vacuum plates and developed loading procedures. This concluded with the designing and ordering of **MELF solder dipping** fixtures, writing of automatic test programs and directing all **burn-in, HTRB and environmental test**.

Special**:** Presented two of my designs to an international convention in Holland hosted by ESA (European Space Administration). Developed computer simulation models of Schottky rectifiers (including rings and overlay), TVS, zeners, metal bump plating, lifetime doping and others for use to train and enable engineering.

Additional Special: Accepted a second responsibility as Commercial Products Sales Manager for the entire fledgling Schottky diode line covering the United States and Canada. I traveled extensively, trained sales Reps and have opened up many difficult accounts.

Engineering Manager — **Discrete Products Division, Omnirel L.L.C.**

- Managed a broad spectrum of components including regulators, MOSFET's, BJT's, IGBT's, Schottkys, FRED's and operational amplifiers. Packages included glass and ceramic sealed TO-257, TO-254, TO-258, TO-259, TO-267, power SIP's and DIP's and TO-3's, plus a variety of SMD's including LCC's, SMD-1, SMD-2 plus ribbon strain-relieved SMD's. SMD package materials included alumina, beryllium and aluminum nitride.
- Programs included **Radiation Tolerant** semiconductor testing and **product introduction**.

Special: Developed computer matrix engine of chip, package and product combinations to aid sales and engineering in identifying best offering for customer. This reduced SCD review times from 1-2 weeks down to 1-2 days.

Vice President of Engineering — **Silicon Transistor Corporation**

- Directed and influenced the development of new products and the re-engineering of the geometries and diffusion processes of many older devices through computer simulation. Products included all types of bipolar transistors 20V to 1000V, 100mA to 120A. Several military SCR's are included in the list.
- My control of the waferfab product and process design was a hands-on position. Our waferfab was capable of manufacturing NPN and PNP planar/mesa bipolar transistors from 15x15 mils to at least 375x375 mils.

Special: Developed simulation models and introduced technology necessary to solve production yield and reliability problems with small signal (2N2222A and 2N2907A) transistors. Over 1 million were produced with excellent wafer-to-wafer repeatability.

Director of Technology — **Semicon Components, Incorporated**

- Responsible for the direction and the development of company waferfab and assembly technology. Chief technical contact for new and old customers including DSCC.

Special: Developed rectifier bridge that opened door to the space industry, taught us the necessary documentation disciplines and brought in over $100,000 with this first space customer.

Director of Engineering — **Semicon Components, Incorporated**

- Responsibilities covered both development and production engineering in waferfab and assembly. Introduced process design changes that resulted in accurate zener and rectifier voltage targeting.

Special: Successfully compressed production areas by re-engineering the processes. This resulted in a 10 times reduction in floor space, a 5 times reduction in chemical usage, major improvements in yields, and a line that ran with minimum engineering supervision.

Research and Development Manager — **Semicon Components, Incorporated**

- **Developed glass axial power products** including transient voltage suppressors and power zeners. Introduced many basic technologies such as E-Beam, CVD and glassivation. Was the technical resource for the corporation.

Special: Developed glass mesa and glass double-slug diodes that became a $1,000,000 annual business for the company. Product line expanded to higher power and bi-directional functions. The extremely low cost design could be built at 25% of all the competition designs allowing us to capture an early market share.

Engineering Manager — **Power Transistor Plant, TRW Semiconductors**

- Directed wafer, mechanical assembly and test of both commercial and military power transistors and Darlington automotive devices. Used computer simulation to improve product targeting and optimize performance.

Special: Solved power transistor yield problems with personally developed modeling software. This first application of such modeling in the plant resulted in yields that jumped from 5% to 70%.

Engineering Key Account Manager — **Diodes and Assemblies Plant, TRW Semiconductors**

- **Full customer interface responsibilities** (sales, applications and forecast) plus full plant product engineering for all account related products. Significant product development was included. Given increased engineering and development responsibilities.

Special: Developed TRW's double-slug diode and received patent. This became foundation of all glass diode products and resulted in $2,000,000 in business annually. Other patents for associated developments.

Applications Engineering Manager — **Diodes and Reliability Plant, TRW Semiconductors**

- Developed application notes, spec sheets and product profiles. Worked with customers to design-in TRW components. Visited key accounts. Influenced new product design.

Accomplishments and Skills

Waferfab

Theory and implementation of diffusions (deposition, drive, gas, solid, liquid, spin-on, paper) using P, B, As, Al, Au & Pt. Thin films (metals and insulators, E-Beam, sputtering, filament, CVD). Thermal oxide process (dry, wet, torch, TCA) as well as oxide etch. Developed models for oxide formation and dopant masking characteristics. Photoresist equipment, process and control. Multi-layer photomask design.

Mechanical Assembly and Test

Packaging (axial, metal, flat-pack, SMD and MELF plus Al and Au wire bonding). Metallurgy (die mount, package integrity, thermal, stress, fatigue). Plating (tin, tin-lead, nickel, gold, silver) onto many surfaces. Test equipment use and programming (automatic, manual, t_{rr}, theta, surge, clamp, parametric, handlers).

Wrote computer models to calculate thermal impedance of all discrete product and SOA plotting of all transistors.

QA/QC

Reliability support (numerous military programs) and design (HTRB and burn-in ion drift and hot carrier failure and prevention, IOL, temperature). SPC training and implementation. Process improvement and control by computer modeling.
Consulted on Space and Military product failure analysis and customer interface.

Government-Industry

DSCC, JC-13, JC-22 and G-12 relationships. Over 25+ years of partnership with the government.
Chairman of JC-22, Chairman of JC13.1 Leak Rate Task Group

Computer Modeling and Simulation

Computer proficient—Developed models for diffusion, oxidation, masking, and parametric predictions, plus targeting and emulation of transistors, rectifiers, Schottkys, transient suppressors and zeners.

New Product-Marketing-Applications

Custom product including voltage regulators (DSCC SMD's), MOSFET's, IGBT's, FRED's, HV Rectifiers, Schottkys, BJT's, SCR's and Operational Amplifiers using DBC and thick film substrates. Customer marketing, applications, field presentations, service and custom design. Radiation Tolerant program.

Radiation Hardness Testing

High dose rate total induced dose (TID) and extremely low dose rate sensitivity (ELDRS)
Initiated and created radiation test program and equipment for the Lawrence Discrete Product Division

Company History

Microsemi Semiconductor	2001 to 2016	Engineering Fellow, Director of Technology
Sensitron Semiconductor	1999 to 2001	Director of Technology
Omnirel L.L.C.	1998 to 1999	Engineering Manager, Discrete Products Division
Silicon Transistor Corporation	1997 to 1998	Vice President of Engineering
Semicon Components, **Inc**.	1981 to 1997	Director of Technology
TRW Semiconductors	1965 to 1981	Engineering Manager, Power Transistors

Formal Education

Cal Poly University — Pomona, California
Bachelor of Science, Electronic Engineering
Member, Sigma Pi Alpha honor fraternity

UCLA — Los Angeles, California
Postgraduate work in computer logic

University of Massachusetts — Lowell, Massachusetts
Licensed Toxics Use Reduction Planner for the State of Massachusetts

General Electric Corporation — Andover, Massachusetts
Total Quality Management (TQM)

Hamilton Standard Corporation — Windsor Locks, Connecticut
Statistical Process Control and Design of Experiments

Patents

3844029	*High Power Double Slug Package*. Design permitted simultaneous silver slug end bonding with molybdenum dioxide side seals.
4039702	*Method for Settling a Glass Suspension Using Preferential Polar Adsorption*. This has become a standard in the industry for centrifugal deposition of glass.
4126713	*Forming Films on Semiconductor Surfaces with Metal-Silica Solution*. Pioneered early gold and platinum doping films.
4190458	*Metal Solution for Forming Films on Semiconductor Surfaces*. Conductive metal films palladium films on silicon.
4243427	*High Concentration Phosphoro-Silica Spin-On Dopant*. Pioneered high concentration dopant system employing alumino-phosphoro-silica spin-on dopant films.
4979076	*Hybrid Integrated Circuit Apparatus*. Design embeds chip components within the assembly board for a watertight seal or, if ceramic is used, a hermetic seal.
5113579	*Method of Manufacturing Hybrid Integrated Circuit*. Assembly process for the above design.
Pending	*Room Temperature Electroless Gold Plating System*. Used to metallize devices protected with delicate glassivation systems.

Please see Separate Supplemental Attachments:

"Skills and Accomplishments Packet"

"Problem Solving Packet"