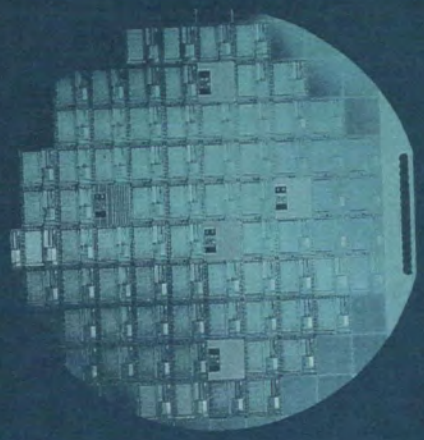
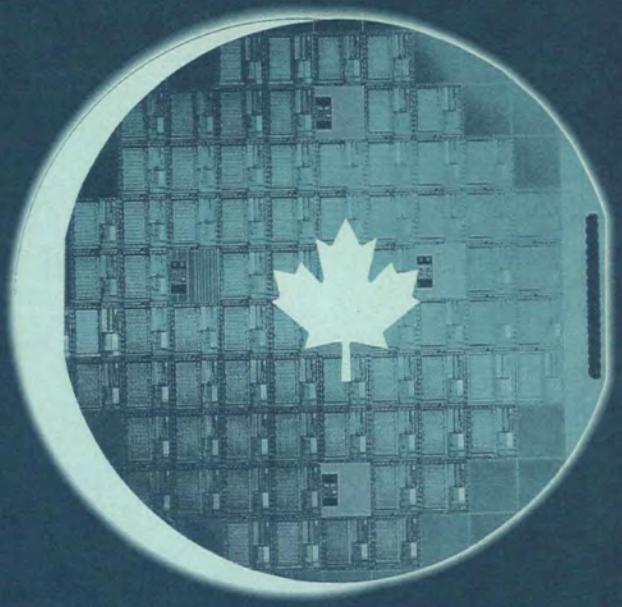
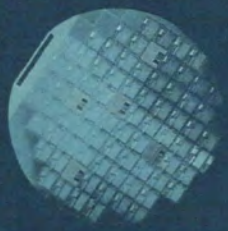




# The Microelectronics Industry in Canada

## A Capability Guide

## 1993



# THE MICROELECTRONICS INDUSTRY IN CANADA

## A Capability Guide — 1993



TELECOMMUNICATIONS AND MICROELECTRONICS DIVISION
INFORMATION TECHNOLOGIES INDUSTRY BRANCH
INDUSTRY, SCIENCE AND TECHNOLOGY CANADA
MARCH 1993

Cat. No. C2-135/1993E

ISBN 0-662-20472-7

IT PU 0041-92-01

***Également disponible en français.***


# CONTENTS

# FOREWORD

This publication presents an overview of the microelectronics industry in Canada and a profile of the capabilities of individual companies engaged in microelectronics-related activities. It is intended for a variety of users — such as information technology corporations in Canada and abroad, communications equipment manufacturers, and systems integrators — who would be interested in Canadian capabilities. Company information may also encourage the formation of strategic alliances and cooperative efforts.

This is one of a series of capability guides produced by the Telecommunications and Microelectronics Division to promote the international competitiveness of the Canadian information technologies industry.

The text for the company profiles was provided by the companies, and we wish to thank all those who contributed to this publication.

For more information, please contact:

Telecommunications and Microelectronics Division
Information Technologies Industry Branch
Industry, Science and Technology Canada
235 Queen Street
OTTAWA, Ontario
K1A 0H5
Tel.: (613) 952-8417

# PREFACE

### Staying out in Front

In the fast-paced world of microelectronics, competitive technology is what it's all about. Advanced science, superb engineering and sophisticated production are only basics in this $62 billion plus worldwide market. Staying out in front takes more. It requires a spirit of innovation — the ability to turn what is into what could be. That spirit has always been the strength of Canada's microelectronics industry.

### Building on a Solid Foundation

Global experience confirms that the semiconductor industry prospers when driven by large, integrated markets. The Canadian industry is founded on a communications business that began when Bell invented the telephone here more than one century ago.

Our vast distances and legendary appetite for communications services have since inspired generations of Canadian scientists and engineers. From satellite technology and advanced fibre-optic phone systems to automated digital switching equipment, Canadian firsts have helped bring together a far-flung world.

Communications equipment will continue to push the Canadian microelectronics industry forward as semiconductor components edge toward 15% of equipment value this year. This will be the lead focus of research advances too, propelled by the industry's key research enterprise, Bell-Northern Research Limited — one of the world's largest.

### "Finishing School" for Ideas

Over the years, the communications industry has served as the nucleus and "finishing school" for an ever-diversifying Canadian semiconductor business. The first crop of microelectronics enterprises sprouted up in "Silicon Valley North" — the satellite city of Kanata, west of Ottawa. Here, the presence of Bell-Northern Research and other research labs created the critical mass for the first generation of silicon entrepreneurs.

Today, microelectronics competence flourishes across the nation. Our domestic market is small. But we've learned to compete by seeking opportunities where wit and agility count.

Prominence in select niches in the market has created a new maturity in Canada's industry. Fully 70% of production not destined for "in-house" use in communications equipment is exported. Firms know that every product they produce must be judged as superior to win recognition in the international arena. Design turnaround has to be fast. Quality must be the best that a highly educated and motivated workforce can deliver. Relations with international customers have to be flawless.

**Linking the Next Generation**

The Canadian microelectronics industry has recognized the need to cooperate to offset limitations of scale. Of critical concern is the industry's raw material — trained intelligence.

Currently, 28 Canadian universities — a line-up including some of the world's finest engineering schools — are involved in microelectronics training and research.

Determined to encourage the growth and vitality of this resource, the industry has worked with government and the university community to build strong links between researchers across the nation. Standard computer-design equipment and software were put in place so that on-campus designers and researchers nationwide would speak the same language. The industry would also speak the same language. The industry played a key role in establishing networks to facilitate the exchange of ideas, target appropriate research, and maximize interaction between industry, government and universities.

Microelectronics Design Centres have also been established in a number of provinces. These centres, along with the Canadian Semiconductor Design Association, offer clients who are developing electronics systems a wide range of services, consulting from the prototype stage to production and marketing.

**Beyond VLSI**

The creation of the Canadian Microelectronics Corporation (CMC) at Queen's University added the ability to fabricate and test sophisticated designs. Virtually all Canadian semiconductor firms are members of the corporation. CMC evaluates university research designs and arranges for manufacturing at Northern Telecom Electronics Limited in Ottawa.

Today, university researchers get over 300 of their designs fabricated through this facility annually — a major advance for Canada's know-how and manpower base in very large-scale integration (VLSI).

CMC's on-line expertise and information services to universities across the country have encouraged state-of-the-art research in centres without a major manufacturing base. Research into the development of tools, device physics, manufacturing processes and advanced materials is on the agenda for the next generation of integrated circuits (ICs).

### Industry–Government Partnership

A unique industry-led initiative supported by Industry, Science and Technology Canada (ISTC) spurred the establishment of the Strategic Microelectronics Consortium (SMC) in October 1991. SMC brings companies together in collaborative projects and thus provides a unified front for the small companies in their international liaisons. With contributions from consortium members and ISTC's industrial program funds, SMC forecasts an expenditure of $37 million in the initial four years. SMC has three main objectives: to form research and development (R&D) alliances to generate interlinked core expertise to build competitive products; to seek out emerging markets and new product ideas; and to prospect for additional capital investments to sustain the growth of the industry.

The Microelectronics Sector Campaign is one of a series of sector competitiveness initiatives launched by ISTC to foster government–industry collaboration addressing the emerging needs within Canada's industrial sectors. Founded on extensive consultations with all interested parties and the commitment shown by Canada's microelectronics community, this sector campaign is designed to support the industry's strategic plans and to provide a focus for government actions. The overall objective is to build on existing strengths and to position the industry to take advantage of the high growth potential in world markets. A key element of the campaign is to provide targeted assistance to SMC for its technology-development and market-development projects. Other activities include the promotion of overall sector capabilities.

### In Partnership with the World

For international customers, establishing links and ventures with Canadian firms can mean a profitable relationship with brainpower and skills unavailable elsewhere. Most Canadian companies have developed considerable experience working with offshore partners. For Canadian firms these partnerships mean market opportunities and extended product ranges. International partners have discovered that adaptive Canadian expertise means elegant, effective problem solving to get better products on the market — fast.

### Canadian Quality in Every Shipment

In design and production, Canada competes on quality. Advanced, highly automated plants, state-of-the-art production techniques and a conscientious workforce are the norm throughout the industry. The reliability of Canadian circuits, semiconductors and products is a major selling point with customers around the world. Our customers are among the world's most demanding. Their insistence on high-quality, advanced technology has proven one of the Canadian industry's greatest assets.

# CREATION TECHNOLOGIES INC.

400 Brooksbank Avenue
North Vancouver, British Columbia
Canada V7J 1G9

**Telephone: (604) 980-6850**
Fax: (604) 980-6711

**Contact:**
Mr. Barry Henderson, Chairman

Creation Technologies Inc. (CTI) designs, manufactures and markets electronic products for the music and audio industry. CTI also manufactures and markets custom thick-film hybrid and surface-mount assemblies for the audio, medical, telecom, instrumentation and industrial controls industries.

**Major Achievements**

- CTI has implemented "lean manufacturing," which has significantly lowered cycle times and improved yields.
- CTI has developed several innovative low-power electronic music accessories powered by musical instrument digital interface (MIDI) signals.
- CTI has developed worldwide marketing channels for the distribution of music and audio products.
- CTI is continually developing state-of-the-art manufacturing processes, including flip chip, fine-line and multilayer printing.
- CTI has developed strategic relationships with key industry players in the digital audio and video marketplace.

**Profile**

| | |
|---|---|
| Sales Volume: | $2.8 million |
| Employees: | 35 people |
| Key Customers: | • More than 2 500 music and audio retail outlets worldwide, Radio Shack and Kawai Canada<br>• Hughes, Bendix, Gandalf, Data I/O, SR Telecom, Rockwell, Sanchez, Eaton Corp. |

**Background**

CTI was founded in 1989 as a music recording studio. The company focuses on developing an integrated digital audio and video production environment for the home studio market. Custom hybrid and surface-mount assemblies provide profits and technology to fuel the development of new products.

**Company Mission**

"We will be the best at creating innovative and superior value electronic solutions for the needs of our customers in the audio, medical, telecom, instrumentation and industrial controls markets."

**Company Goals**

- Inspire an innovative environment where all employees have the freedom to create and strive for continuous improvement.
- Be an agile enterprise and "manage without managers."
- Provide a rewarding workplace with fair compensation, proper recognition and challenge for all employees.
- Aim for a "win–win" relationship with all key stakeholders.

# DALSA INC.

605 McMurray Road
Waterloo, Ontario
Canada N2V 2E9

**Telephone: (519) 886-6000**
Fax: (519) 886-8023

**Contact:**
Dr. Savvas Chamberlain,
President

Dalsa specializes in the research, design, development and manufacture of high-performance, solid-state charge-coupled device (CCD) image sensors and modular expandable cameras. These cameras provide the highest spatial resolution at the highest data-transfer speed of any known products in the industry. Dalsa's CCD image sensors and cameras are used worldwide in document scanning, image capture, surveillance, process monitoring and manufacturing inspection. Dalsa also develops customized products for specific customers and applications.

**Major Achievements**

- Dalsa developed, patented and marketed more than 75 different models of modular expandable cameras that incorporate the TURBOSENSOR™ and QUIETSENSOR™ technology developed by Dalsa.
- Dalsa developed and marketed CCD TURBOSENSOR™ line-scan and area-scan technology. TURBOSENSOR™ technology uses an advanced CCD shift register profiled for high-speed operation. TURBOSENSOR™ technology is ideal for high-speed inspection and document scanning.
- Dalsa developed and marketed CCD QUIETSENSOR™ time delay and integration (TDI) line-scan technology for high sensitivity and low-noise operation under low-light conditions. QUIETSENSOR™ technology provides 80 times more sensitivity than comparable line-scan sensors. It is ideal for scanning and inspection applications requiring high spatial resolution at a high data-transfer speed under low light conditions.
- Dalsa developed, patented and marketed CCD DYNASENSOR™ technology with a dynamic range of more than 1 000 000:1. This device is suitable for applications requiring a wide optical dynamic range, such as welding vision and space applications.
- Dalsa is a world leader in large-area format CCD image sensors and has developed a 5000 × 5000 CCD image sensor.

**Profile**

| | |
|---|---|
| Sales Volume: | Dalsa sales volume has been increasing by nearly 50% per annum, with a present split of 80% standard product sales and 20% custom-design product sales. |
| Employees: | Dalsa has more than 60 full-time employees, including a high-level engineering group and manufacturing staff, at its Waterloo plant. Dalsa has approximately 80 sales representatives in 40 sales offices worldwide. |
| Key Customers: | • Standard products have been recognized by such industry leaders as Kodak, DuPont, Quad Graphics, IBM and NCR.<br>• Dalsa also offers custom design services for designed-in products or modifications to Dalsa's standard products. |

**Background**

Dalsa was established in 1980 and capitalized in November 1984 by Dr. Savvas Chamberlain in Waterloo to pursue advanced CCD design. Dalsa now has a product line of over 100 image sensors and modular expandable cameras.

Dalsa designs and manufactures its products in a 1 115 $m^2$ custom design facility in Waterloo, Ontario. The facility, entirely owned and operated by Dalsa, has specialized anti-static class-100 clean rooms to assist in the design and manufacture of Dalsa's state-of-the-art technology. Dalsa also leases additional space adjacent to the Dalsa facility.

**Current Marketing Activities**

An agent network handles sales and export of custom and standard products worldwide. Dalsa places a strong emphasis on demonstrations at numerous trade shows throughout the world.

**Strategic Alliances**

Dalsa has various alliances in specialized markets. Dalsa seeks strategic partners with an ambition to co-develop new technologies or enhance present-day products.

# EG&G Optoelectronics Canada

22001 Dumberry Road
Vaudreuil, Quebec
Canada J7V 8P7

**Telephone: (514) 424-3300**
Fax: (514) 424-3411

**Contact:**
Mr. Ron Swarbrick,
General Manager

EG&G Optoelectronics Canada (formerly GE/RCA Inc., Electro Optics) provides research, development and manufacturing capabilities for state-of-the-art electro-optical components and subsystems for use in applications such as laser range finding, optical proximity fusing, target designation, tracking, weapon fire simulation, line-of-sight optical communications, fibre-optic communications, test equipment, measurement and controls.

**Major Achievements**

- EG&G is a major supplier of receivers for optical communications in space.
- EG&G is a major supplier of receivers and transmitters for ground-based military fibre-optic communications.
- EG&G is a major supplier of components for optical missile guidance, range finding and fusing.
- EG&G is a major supplier for advanced optical countermeasure systems.
- EG&G is a supplier of components for optical computing systems.
- EG&G is a supplier of electro-optical components for the industrial and medical markets.

**Profile**

| | |
|---|---|
| Sales Volume: | >$25 million |
| Employees: | Approximately 170 scientists, engineers and specialist support staff |
| Key Customers: | Major U.S. and European defence, aerospace and communications organizations |

**Background**

This organization's research on semiconductor materials, which was initiated in the late 1940s, has given it an enviable track record. EG&G Optoelectronics Canada's emitters evolved from technology originating at the David Sarnoff Research Center in Princeton, New Jersey. The detector technology was pioneered by RCA in Montreal, Quebec.

In 1986, the emitter and detector operations were consolidated in an ultra-modern research and manufacturing facility, located in Vaudreuil, Quebec. This facility is one of the most advanced of its kind in North America. All design, development and assembly are performed in-house.

Staffed by an experienced team of scientists, engineers and specialist support staff, this facility incorporates extensive clean-room fabrication and test areas. Operating under the strict RCA Reliability Assurance system, it can meet the most stringent customer requirements to Allied Quality Assurance Provision (AQAP) and other Military Specification (MILSPEC) standards.

**Business Description**

Products include GaAs, GaAlAs, InGaAs and InGaAsP semiconductor injection lasers, laser arrays, infrared emitters and transmitter modules, silicon and InGaAs positive–intrinsic–negative (PIN) photodetectors, avalanche photodetectors, hybrid detector preamplifier assemblies and receiver modules manufactured using the latest silicon and III–V compound technologies.

To ensure device performance, EG&G Optoelectronics Canada tailors leading-edge technology to individual customer's requirements. For example, we have optimized our unique APD structure and proprietary processing for applications from very low-light photon counting, to Nd:Yag receivers requiring 1060 nm response, to systems requiring gigahertz frequency response.

From research to full-scale production, material and device characterization is an integral control aspect of EG&G Optoelectronics Canada's operations. This includes direct scanning electron microscope (SEM) and energy-dispersive X-ray analysis of composition and electron-beam induced-current identification of depletion regions; X-ray diffraction to monitor lattice matching in epitaxial growth; photoluminescence to determine III–V compositions; and Polaron and C-V analysis to determine doping profiles.

More than 70% of our production is of non-catalogue devices and packages. A range of levels of assembly automation is available to customers at the Vaudreuil facility. For initial development and small programs, hand assembly using precision jigs is frequently the most cost-effective approach. By way of contrast, EG&G Optoelectronics Canada's automated furnaces permit the reproducible, high-volume production of tens of thousands of components per month.

**Current Marketing Activities**

EG&G Optoelectronics Canada uses a direct and support approach in North America as it primary channel of distribution. EG&G Optoelectronics Canada has sales offices in the United States and also has distributor agreements covering Europe and the rest of the world.

**Collaborative Arrangements Sought**

- Access to or licensing of fabrication technology.
- Product licensing, cross licensing, and second-source development.

# GENESIS MICROCHIP INC.

2900 John Street
Markham, Ontario
Canada L3R 5G3

**Telephone: (416) 470-2742**
Fax: (416) 470-2447

**Contact:**
Mr. Paul M. Russo, President and CEO

Genesis markets real-time (full-motion) video/image digital-signal processing (DSP) IC products — the Acuity™ family of Image Resizing Engines that can perform high-quality 2-D filtered image resizing (shrink and zoom) at full-motion video rates. Breakthrough, patented proprietary technology makes cost-effective low-chip-count solutions possible. These chips satisfy the fundamental need to manipulate images that exist in almost all real-time imaging systems, including multimedia and video networking.

The company's application-specific integrated circuit (ASIC) business focus is on designs that require custom cells and (or) leverage Genesis' DSP expertise. Design centre and manufacturing relationships have been established with U.S., European and Japanese semiconductor suppliers.

**Major Achievements**

Genesis has developed and perfected breakthrough, full-motion (real-time) video/image DSP technology that is realizable in ICs. This technology consists of patented algorithms licensed on an exclusive worldwide basis from NorthShore Laboratories of Princeton, New Jersey; proprietary chip architectures; and a family of specialized DSP custom cells.

The resulting chips offer an order-of-magnitude improvement in silicon area for a given image quality. These specialized ICs, called the Acuity™ series of Image Resizing Engines, are hardwired pipelined processors capable of executing billions of operations per second.

Genesis' Acuity™ ICs, which can perform image shrink and zoom, contain fully separable finite impulse response (FIR) filters for the vertical and horizontal dimensions. All the memory required for the vertical filtering is contained on chip. These are Genesis exclusives. Marketing of the company's initial Acuity™ products, the gm865 × 1 and gm833 × 2 Image Resizing Engines, has begun.

Genesis has developed a family of proprietary, scalable custom cells (silicon DSP building blocks) in 0.8 micron complementary metal-oxide semiconductors (CMOSs) that are optimized for the realization of advanced DSP algorithms and architectures. The use of these custom cells in combination with advanced IC design methodologies allows Genesis to greatly reduce its new product introduction cycle — a major competitive advantage.

**Company Profile**

Sales Volume: $2 to 3 million (forecast 1993)

Employees: 18 people

Key Customers:

- Genesis has a large number of ASIC customers in both the United States and Canada.
- The company expects to begin sampling its video DSP IC products by mid-1993 and anticipates having the majority of its customers from outside Canada (United States, Japan, western Europe). The list is expected to include major original equipment manufacturers (OEMs) in the personal computer (PC) multimedia, broadcast, medical imaging, video projector and video teleconferencing markets.

**Company Profile**

Genesis was founded in 1987 and is an established "fabless" semiconductor company focusing on the development and marketing of proprietary real-time video/image DSP ICs (growth opportunity), as well as R&D-intensive and DSP-oriented ASICs (core business).

With a single, tightly knit organization having advanced expertise from fully custom IC and ASIC design through system and video DSP algorithms and architecture development, Genesis is truly unique.

Genesis has recently introduced its initial products (Image Resizing Engines) to the market. These parts use breakthrough video/image DSP algorithms and architectures licensed on an exclusive, worldwide basis; internally developed, proprietary silicon building blocks; and IC realization technology. The manufacturing is subcontracted to major semiconductor manufacturers in the United States and Japan.

**Current Marketing Activities**

The gm865 × 1 is a 65-tap, broadcast-quality, single-channel Image Resizing Engine (one chip for monochrome, two chips for Y–UV, three chips for red green blue (RGB)). The gm865 × 1 is expected to be sampled in the second quarter of 1993. The gm833 × 2 is a highly integrated device offering two channels (Y–UV) of high image-quality full-motion image resizing targeted at multimedia/video networking applications. The gm833 × 2 is expected to be sampled in the third quarter of 1993. Additional real-time video/image DSP ICs, including the gm833 × 3 (RGB), will be introduced on an ongoing basis (four to five new devices per year).

Genesis also markets its capability as an advanced third-party ASIC design centre with a focus on turnkey design, ASIC consulting, custom cell development and DSP-oriented ASICs. In particular, Genesis can offer ASICs that contain its Image Resizing Engines as cores.

**Collaborative Arrangements Sought**

Genesis is interested in a number of possible types of strategic partners.

Customer Partners: OEMs, whose products could benefit from the incorporation of ASIC versions of Genesis' standard video/image DSP ICs; the relationship could include joint R&D, technology licensing and investment in Genesis

Sales Partners: Representatives, distributors and trading companies that may have an interest in becoming sales channels for Genesis products

Industry Partners: Major semiconductor companies that may have an interest in selling video/image DSP products based on Genesis technology; the relationship could include joint R&D, technology licensing, certain product rights, and investment in Genesis

It is anticipated that any one partnership may embody more than one element of the above types of relationships.

# GENNUM CORPORATION

P.O. Box 489, Postal Station A
Burlington, Ontario
Canada L7R 3Y3

**Telephone: (416) 632-2996**
Fax: (416) 632-2055

**Contact:**
Mr. Bryon Nielsen,
General Sales Manager

Gennum designs, manufactures and markets electronics components, primarily silicon ICs for specialized applications.

**Major Achievements**

- Gennum is considered a world leader in the design of circuits fabricated using bipolar technology for operation at low voltages (e.g., 1.0 V).
- Gennum is a leading supplier of electronic amplifiers and peripheral circuitry to the global hearing-instrument industry. Gennum has captured about 65% of this market.
- Gennum has developed a family of superior crosspoint switches for switching and routing video signals in the video communications industry.
- Gennum has developed a family of high-speed serial digital interface chips for the broadcast video market.
- Gennum has developed a line of proprietary ultraminiature device package configurations, including tape automated bonding (TAB).
- Gennum's internal manufacturing capability ranges from fabricating wafers to assembling and testing devices.

**Company Profile**

| | |
|---|---|
| Sales Volume: | $23 million |
| Employees: | 230 people |
| Key Customers: | All manufacturers of hearing instruments in Canada, the United States, western Europe and Japan |

**Company Background**

Gennum was formed in 1973. The company designs and manufactures linear devices using bipolar fabrication technology. The company operates from two modern plants in Burlington, Ontario. Total plant space is approximately 7 000 $m^2$.

Gennum spends the equivalent of approximately 20% of its annual sales on new technology and product development and invests another 20% in equipment and facilities. Since 1982 Gennum has been a public company trading on the Toronto Stock Exchange. The company has an agreement with EM Microelectronics of Switzerland to use its low-voltage CMOS process for product design.

**Business Description**

Gennum's core products include the following:

- A family of monolithic and hybrid ICs that provide the miniaturized electronic functions in the manufacture of hearing instruments — Gennum provides customized and proprietary products and application support to hearing-instrument manufacturers worldwide.
- A family of custom and proprietary ICs for specialized applications in video instrumentation and routing systems.
- A set of proprietary power-controlled ICs using resonant-mode techniques for high-voltage, low-power and miniature-power supplies.
- Custom ICs designed for specific requirements in the communication industry.

**Current Marketing Activities**

The company conducts market research and marketing activity in support of its product lines.

The company's own sales force distributes most of its hearing-instruments products. Other products are distributed directly and through manufacturers' agents throughout the world.

The company operates a branch office in Tokyo to service the Japanese market.

**Collaborative Arrangements Sought**

- Access to or licensing of fabrication technology.
- Product licensing, cross licensing, and second-source development.
- Establishment of design centres based on our technology.

# IBM CANADA LTD.

(Bromont Plant, Quebec)
23 Airport Boulevard
Bromont, Quebec
Canada J0E 1L0

**Telephone: (514) 534-6386**
Fax: (514) 534-7019

**Contact:**
Mr. Mike Wong, Plant Manager

IBM Bromont is a full-service supplier of semiconductor packaging and test services. Our wide range of manufacturing processes and the concentration of key technologies enable us to satisfy our customers' varied and evolving needs.

**Major Achievements**

Over the years, IBM Bromont has acquired a strong reputation for consistently exceeding its quality and delivery commitments.

IBM Bromont is the sole IBM supplier in North America of a wide range of packaging solutions, such as metalized ceramics (MCs), multilayer ceramics and different plastic packages, including the 1 and 4 megabit memory chip modules.

IBM Bromont is the manufacturing centre of competence for the plating process using different chemicals. We can plate on ceramic, polyamide film, various metals and lead frame.

Our manufacturing lines are fully automated and equipped with the finest waste-treatment facilities for environmental protection.

**Company Profile**

Value-Added Output: $200 million

Employees: 1 550 people

Key Customers:
- IBM U.S. semiconductor plants
- All manufacturers of devices in Canada, the United States, Europe and Japan

**Company Background**

The Bromont plant, opened in 1972, is located in the Eastern Townships, 75 km southeast of Montreal. Today the plant has approximately 1 500 employees operating out of a 6 970 $m^2$ facility. Investments since 1981 have reached more than $0.5 billion dollars in the Bromont plant.

IBM Bromont has won many awards and recognition. For example, in 1990, the plant won the Canada Award for Business Excellence in Quality from ISTC. In the same year, the plant won the National Productivity Award from the Canadian Society for Industrial Engineering. In 1992, the plant was a finalist in the Mercuriades Award for its environmental programs and won the Canada Export Award from the Minister of International Trade.

**Business Description**

IBM Bromont offers TAB in a variety of standard peripheral formats conforming to the standards of the Joint Electron Device Engineering Councils (JEDEC) and the Electronic Industries Association — Japan (EIA-J). We can provide inner lead bindings (ILB) that can use either conventional peripheral thermo-compression bonding or area-array solder-reflow attach.

Plastic flat pack is a generic name applied to slim plastic. IBM Bromont currently manufactures 124 L to 208 L packages. These conform to JEDEC input/output (I/O) and footprint standards with lead pitches of 0.65 and 0.5 mm. For applications that warrant it, the 208 L, 0.5 mm pitch copper–lead frame package offers superior electrical conductivity and thermal heat dissipation.

Bromont also offers a ceramic quad flat pack (CQFP). This package further enhances the MC pin grid array (PGA) technology base to bring the performance, reliability and extendibility of MC technology to surface-mount customers. This technology is flexible and adaptable to specific requirements such as non-standard body sizes, I/O counts or lead pitches.

We can perform a broad range of module-test and module- or chip-level burn-in functions. The Bromont test engineering group will work closely with you, the customer, to ensure that your products meet all of your functional and reliability specifications.

Reliability requirements, particularly in the areas of multichip direct chip attach (DCA), warrant a versatile burn-in option.

At IBM Bromont, as part of our full-service offering, we can provide professional consultant services and turn-key projects in several areas:

- Total-quality management (TQM).
- Facilities management.
- Supplier quality program and engineering design & inspection (EDI) training.

**Business Arrangements Sought**

- Electronic packaging product sales.
- Joint technology development.
- Business alliances for new-product introduction.

# INTERNATIONAL EPITEK INC.

100 Schneider Road
Kanata, Ontario
Canada K2K 1Y2

**Telephone: (613) 592-2240**
Fax: (613) 592-9449

**Contact:**
Mr. Robert W. Corson, President and CEO

Epitek designs and manufactures custom thick-film hybrid circuits and surface-mount board assemblies for customers producing telecommunications, automotive, medical, computer, test instrumentation, and consumer electronics products. At present, all of Epitek's products are custom products.

**Major Achievements**

- Epitek has developed and implemented a process for high-volume manufacturing of chip-on-board (COB) assemblies using fully automated gold-wire bonding.
- Epitek is a quality- and service-oriented company. Our delivery-performance history is 98% of product delivered within +1 day of committed date.

**Company Profile**

| | |
|---|---|
| Sales Volume: | $5.6 million (1991); $8.4 million (1992) |
| Employees: | 80 people |
| Key Customers: | Onan Power (United States) |
| | Medisense Inc. (United States) |
| | Electro-Voice (United States) |
| | Sangamo (Canada) |
| | Unisys (United States) |
| | Amdahl (Canada) |
| | Harris Farinon (Canada) |
| | Farady (United States) |
| | Analogic (United States) |
| | Litton (Canada) |

**Company Background**

International Epitek Inc. was founded in 1969 and was one of the first merchant hybrid houses in Canada. The company went public in the early 1980s and is currently traded on the Toronto Stock Exchange. In the spring of 1990, the senior management team became majority owners by taking over the interests previously held by a venture-capital firm.

**Business Description**

Epitek's prime business is the supply of hybrids and surface-mount assemblies and COB devices custom designed and manufactured for specific customers.

**Current Marketing Activities**

Epitek sells its services through manufacturer representatives in Canada and the United States. At present, it has no sales in Europe or Asia.

Epitek is expanding its North American sales activities by adding more manufacturer representatives in regions currently not covered.

As Epitek has a substantial amount of idle capacity, it is also looking for product opportunities that would use its facilities and at the same time give it some standard products of its own. Epitek is also interested in a range of partnering arrangements to use its excess capacity while expanding its standard product line.

**Collaborative Arrangements Sought**

Epitek is interested in expanding its business and gaining strategic equity or business partners. Possibilities include the following:

- A joint venture involving the use of Epitek's custom assembly services.
- Manufacturing arrangements with firms wanting to increase their Canadian content.
- North American licensing or royalty arrangements with European firms that have products Epitek could manufacture and sell in North America.

Note: Epitek's partnering interests are not necessarily limited to the above-mentioned arrangements.

# Les industries CMAC Inc.

3000 Industriel Boulevard
Sherbrooke, Quebec
Canada J1L 1V8

**Telephone: (819) 821-4524**
Fax: (819) 563-1167

**Contact:**
Mr. Denis Marchand,
Vice-President, R&D

CMAC is the largest Canadian contract manufacturer for the electronics industry. CMAC offers its customers a full range of packaging technologies, including hole- and surface-mount assembly of printed circuit boards (PCBs) and thick-film hybrid circuits.

CMAC is a certified supplier for some of the leading electronic companies. It offers a broad range of services to the industry, including the design and manufacture of thick-film hybrid circuits and resistor networks, surface-mount and conventional through-hole PCBs and system assembly, and custom electronic controls and systems.

**Major Achievements**

In only five years, CMAC has become the largest contract manufacturer in electronics in Canada.

**Background**

CMAC is one of the largest independent subcontractors in microelectronics in Canada. CMAC started its operations in 1985 as a manufacturer of custom thick-film hybrid circuits and resistor networks for the telecommunications industry and rapidly became the largest Canadian supplier of custom hybrid circuits.

CMAC operates two state-of-the-art facilities in Canada. The first plant houses the hybrid circuits and surface-mount operations. It covers an area of 4 000 $m^2$, with approximately 1 700 $m^2$ of class-10 000 clean rooms used for screen making, screen printing, firing, laser trimming and specialized quality-assurance services. All PCB and system assembly operations are concentrated in the second plant, which has a 6 700 $m^2$ manufacturing area. In both facilities, automated processes (e.g., automatic screen printing, firing, laser trimming, Pick-&-Place, automatic sequencing and insertion tests), robotics, statistical process control (SPC), and JIT (Just-in-Time) and MRP-II systems ensure excellent and consistent quality products. CMAC also operates four other facilities, two in Florida, U.S.A. — hybrid circuits and backplane, and two in England — hybrid circuits dedicated to aerospace and military; and quartz crystal manufacturing.

CMAC, through its 1990 acquisition of the Energy Division of CONSULAB (Quebec City), also designs and manufactures complex controls and systems for the electrical industry.

**Profile**

| | |
|---|---|
| Sales Volume: | $22 million |
| Employees: | 360 people |
| Key Customers: | Northern Telecom Ltd. |
| | Computing Devices Canada |
| | Philips |
| | Silicon Graphix |
| | Ametek |
| | Telenex |
| | Telenet |
| | Apple Computer |
| | Hydro Quebec |
| | IBM Canada |
| | COMPAQ Compute |
| | Litton Systems |
| | TIE Communications |

**Business Description**

CMAC offers many services to the electronics industry:

- Design and manufacturing of custom thick-film hybrid circuits and resistor networks.
- Multilayer, high-precision printing on ceramic.
- Surface-mount PCB assembly.
- Conventional through-hole PCB assembly (automatic insertion).
- Electronic systems assembly.
- Special quality-assurance services in a controlled environment (clean rooms).
- $CO_2$ laser scribing and machining.

**Current Marketing Activities**

- Direct sales and sales representatives in North America.

**Collaborative Arrangements Sought**

- Contracts to manufacture electronic products (hybrids, system assembly, PCB assembly).

# LSI Logic Corporation of Canada

150-6th Avenue S.W., Suite 3410
Calgary, Alberta
Canada T2P 3Y7

**Telephone: (403) 262-9292**
Fax: (403) 262-9494

**Contact:**
Mr. Robert J. McInnes, President and CEO

LSI Logic Corporation of Canada designs, develops, markets and manufactures ASIC and related design software and services. The company also designs and markets 32-bit SPARC and MIPS reduced instruction-set computer (RISC) microprocessors, DSP and video-compression chip sets, and PC chip sets. The company also offers circuit board assembly. MILSPEC is available in most product lines.

**Profile**

Sales Volume: $59 million (1991)

Employees: 150 people

Key Customers:
- Manufacturers of telecommunications, defence, aerospace and other peripheral industrial communication industries
- Manufacturers of PCs and workstations in Canada, the United States and South Korea

**Background**

LSI Logic Corporation of Canada was incorporated in December 1985 and is a public company traded on the Toronto, Montreal and Alberta stock exchanges under the symbol LSC. Since its inception in Canada, it has successfully completed more that 700 ASIC designs and generated approximately $250 million in sales.

The company operates design centres in Vancouver, Edmonton, Calgary, Toronto, Ottawa and Montreal. The company has a wholly-owned subsidiary, LSI Logic Corporation of Korea, which operates a design centre in Seoul.

Canadian manufacturing facilities, located in Edmonton, Alberta, and Sydney, Nova Scotia, offer surface-mount and through-hole circuit board assembly services. Through affiliations with LSI Logic Corporation of Milpitas, California, LSI Logic Japan and LSI Logic Europe, submicrometre-ASIC manufacturing is also offered to Canadian and Korean customers.

LSI Logic Corporation of Canada is a 55%-owned subsidiary of LSI Logic Corporation, with headquarters in Milpitas in the Silicon Valley of California.

LSI Logic Corporation is a Fortune 500 public company traded on the New York Stock Exchange under the symbol LSI. It was founded in 1981 and since its inception has successfully completed more than 1 200 ASIC designs. Its 1991 revenues were $700 million.

**Business Description**

LSI Logic Corporation of Canada products and services include the following:

- ASIC.
- CMOS gate arrays, embedded arrays and cell-based design tools.
- VHDL Silicon 1076.
- Concurrent Modular Design Environment (C-MDE).
- Modular Design Environment (MDE).
- Microprocessor: 32-bit RISC standard product and embedded cores based on both MIPS and SPARC architectures.
- DSP and video compression: core DSP building blocks, JPEG, MPEG.
- PC chip sets: single-chip and two-chip core logic products for 286, 386DX, 386SX 486DX, 486SX, videographics adaptors (VGAs).
- System design engineering services.
- Circuit board assembly: automated fine pitch surface-mount and through-hole assembly.
- Engineering services.

**Design Centres**

492-6400 Roberts Street
Burnaby, British Columbia
Canada V5G 4C9

**Telephone: (604) 294-8444**

401 The West Mall, Suite 1110
Etobicoke, Ontario
Canada M9C 5J5

**Telephone: (416) 620-7400**

260 Hearst Way, Suite 400
Kanata, Ontario
Canada K2L 3H1

**Telephone: (613) 592-1263**

755 St-Jean Boulevard, Suite 600
Montreal, Quebec
Canada H9R 5M9

**Telephone: (514) 694-2417**

LSI Logic Corporation of Korea, Inc.
7th Floor, Namseoul Building
1304-3 Seocho-dong
Seocho-Ku
Seoul, South Korea

**Telephone: 011-82-2-561-2921**

**Board Assembly Facilities**

150 Karl Clark Road
Edmonton, Alberta
Canada T6N 1E2

**Telephone: (403) 450-4400**

490 Gateway Avenue
P.O. Box 1403
Sydney, Nova Scotia
Canada B1P 6R7

**Telephone: (902) 562-3758**

# MIRANDA RESEARCH INC.

5695 St-François Road
St-Laurent, Quebec
Canada H7P 4V5

**Telephone: (514) 333-1772**
Fax: (514) 333-9828

**Contact:**
Mr. Christian Tremblay,
President of the Board

Miranda develops electronic equipment for the television industry.

**Major Achievements**

- Miranda develops, manufactures and markets the latest in leading-edge digital video products through a worldwide distribution network.
- Miranda has several advanced R&D projects, including a contract with the Canadian Space Agency for a multiple-image high-definition television (HDTV) workstation.
- Miranda is a third-party developer for the Matrox Studio desktop video system, for which we have developed "Titania," a 3-D special-effects card.
- Miranda products are sold on a OEM basis by well-known companies such as Barco (Belgium), Getris (France), and Chyron (United States).

**Company Background**

Founded in 1989 by five engineers specialized in digital image processing, Miranda is 100% owned by the management team of the company. Miranda Research is responsible for R&D activities, and Miranda Technologies manufactures and markets the product. Together, the two companies form the Miranda Group. Miranda Technologies owns 50% of TMI Technologies Inc., a joint venture responsible for the development of video DSP chips.

**Business Description**

Miranda manufactures interface products for larger equipment, such as cameras, videotape recorders (VTRs) and production switchers. We have become specialists in converting video formats from analogue to digital, serial to parallel, component to composite, and vice versa. Our products are characterized by high quality at an affordable price (less than $10 000).

The following products are currently on the market:

- SER-100 serial encoders
- SEL-500 digital selectors
- DDA-500 digital distribution amplifiers (DAs)
- DEL-600 digital delay systems
- MON-500 monitoring systems
- SDM-100 4:2:2 digital to analogue converters (DACs)
- SDM-200 4:2:NTSC/PAL (National Television System Committee/phase-alternate-line) encoders
- SDM-300 4Fsc (frequency of subcarrier) to analogue converters

**Current Marketing Activities**

The Miranda market is worldwide: 50% of our customers are in the United States, and 50% are in the rest of the world, mainly Europe and Japan. In the United States, our customers are concentrated in Los Angeles and New York, the two major centres for film and television production.

Our customers are mainly small and medium-sized companies operating in the post-production television market; these are the most dynamic enterprises in the television industry. We also deal with major U.S. and Canadian networks: ABC, NBC and CBC. In addition, we sell, on an OEM basis, to larger companies, such as Barco (Belgium) and Chyron (United States).

**Collaborative Arrangements Sought**

- Licence agreements with chip manufacturers on proprietary video DSP technologies developed by Miranda.
- Business collaboration with PCB and hybrid parts manufacturers to offer improved product designs.

# MITEL SEMICONDUCTOR

360 Legget Drive
P.O. Box 13089
Kanata, Ontario
Canada K2K 1X3

**Telephone: (613) 592-2122**
Fax: (613) 592-4784

**Contacts:**
Mr. Kirk Mandy, Vice-President and General Manager

Mr. Ken Anderson,
Assistant Vice-President,
Business Systems

Mitel Semiconductor is Canada's largest merchant semiconductor business and a world leader in the telecommunications and data-communications component markets. It specializes in components for communications systems, including integrated circuits, hybrid microcircuits, and board-level and software products. Products for the integrated services digital network (ISDN) market form one area of specific focus.

**Major Achievements**

- Mitel Semiconductor produces a broad range of advanced communications components in the fields of customer premise equipment (CPE), transmission and networks.
- Mitel Semiconductor produces a major line of CMOS analogue and digital crosspoint switches.
- Mitel Semiconductor designs and manufactures analogue, digital and mixed analogue–digital ICs, hybrids and board-level products for the telecommunications industry.
- Mitel Semiconductor designed and produces a family of ISDN boards, including the ISDN EXPRESS card, which allows easy access to the ISDN functions and is packaged in a PC XT- or AT-compatible plug-in card.
- Mitel Semiconductor has a strong presence and excellent distribution channels in the key international markets of Japan, Europe, and the United States.

**Profile**

Mitel Semiconductor is a privately held division of Mitel Corporation. In fiscal year ending March 27, 1992, Mitel Semiconductor achieved external sales revenues of approximately $40 million.

Employees: 550 people

Key Customers: Mitel Semiconductor markets its products to other Mitel divisions and to the primary merchant markets of Japan and the Pacific Rim, Europe, and the United States

**Background**

Mitel Semiconductor was formed in 1976, when Mitel acquired the assets of a semiconductor facility based in Bromont, Quebec. Mitel began development of its first ISO-CMOS silicon gate process, which was introduced into production in 1979. The high performance of this mixed analogue–digital process in telecommunications applications brought Mitel Semiconductor wide recognition in commercial markets and has made Mitel communication systems the best in the world.

**Business Description**

Mitel Semiconductor has three distinct business areas: integrated circuits, wafer foundry services, and hybrids.

Integrated Circuits

(a) Digital Communications Components

- Digital CPE: components for equipment that resides on the customer's premises, including basic-rate ISDN devices (e.g., S-, U-, R-Interface), proprietary transport devices (e.g., Mitel's digital network integrated circuit (DNIC) interface), and digital phone devices.
- Digital network equipment: primary-rate ISDN devices (T1, CEPT) and digital switching components.

(b) Analogue Components

- Touch-tone receivers and analogue crosspoint switches for manufacturers of analogue equipment.
- Voice-processing components.

Wafer Foundry Services

- World-class silicon foundry services and capabilities.
- Consulting teams experienced in the design, fabrication, packaging, and testing of state-of-the-art digital, analogue and mixed-signal ICs.
- Highly flexible and responsive services.
- Cost-effective manufacturing capability.

Hybrids

- Suit customers who are in the telecommunications business and require high quality, reliability, and precise laser trimming.
- Current process technology: through-hole printing and multilayer interconnect.

**Collaborative Arrangements Sought**

- Technology partnerships to develop and market tele- and data-communications products for the broadband and wireless markets.
- Partnerships to use the capability and capacity of Mitel's wafer foundry.

# MOSAID TECHNOLOGIES INCORPORATED

P.O. Box 13579
Kanata, Ontario
Canada K2K 1X6

**Telephone: (613) 836-3134**
Fax: (613) 831-0796

**Contact:**
Dr. R.C. Foss, Chairman

MOSAID Technologies Incorporated specializes in the technology of memory ICs. The Semiconductor Division designs state-of-the-art dynamic random access memory (DRAM), pseudo-static DRAM, static random access memory (SRAM) and random access memory digital analogue computer (RAMDAC) products for engineering and royalty fees and also sells the components themselves. The Systems Division develops, manufactures and markets cost-effective automatic test equipment (ATE) for the engineering applications and production segments of the memory-test market.

**Major Achievements**

- MOSAID developed and patented folded bit-line architecture for DRAM circuits. This architecture is now an industry standard.
- MOSAID commercially produces low-power 1M DRAM in high volume.
- MOSAID is actively involved in 4 and 16M DRAM and pseudo-static random access memory (PSRAM) designs.
- MOSAID was awarded first prize in Electronic Test Readers' Choice Awards, Memory Testers category.
- MOSAID established a partnership arrangement with a large U.S.-based chip manufacturer and jointly developed a specialized production wafer probe test system.
- MOSAID has established a worldwide network of customers, including major semiconductor memory manufacturers.

**Profile**

| | |
|---|---|
| Sales Volume: | $7 710 000 (1991); $7 299 000 (1992) |
| Employees: | 65 people worldwide |

**Background**

MOSAID Inc. was formed in 1975 as a privately owned and operated R&D engineering company specializing in the technology of memory ICs (chips). MOSAID Systems Inc. was formed in 1982 when the design of a tester product for internal purposes led to a commercial opportunity. MOSAID Inc. and MOSAID Systems consolidated in 1991 under the MOSAID Technologies umbrella. The group exports virtually 100% of its products and has been active in the Far East for more than 15 years.

**Business Description**

The products and services of MOSAID'S Semiconductor Division include the engineering and licensing of JEDEC-standard DRAM, SRAM and graphic chip designs. Current designs are 1M, 4M and 16M DRAM and PSRAM, 1M SRAM, and core cells for colour graphics chips. All designs feature MOSAID's proprietary high-performance architecture and low-power circuitry. In addition to standard designs, MOSAID offers services to integrate these with logic cells to provide custom solutions for systems customers.

To complement the design business, MOSAID also provides product engineering support to ensure smooth integration of design and process, faster yield attainment, and shorter time to market for its semiconductor customers.

MOSAID sells the chips resulting from its designs (such as the lM DRAM and RAMDAC chips) to systems customers.

MOSAID Systems introduced a new ATE product line in the spring of 1991. The line is aimed at both the engineering and production test markets. The first product within the line, the MS3400, is designed to test DRAM, SRAM and memory-intensive ASIC chips up to 256M × 18 bits. The test rate for the system is 20 MHz with a 50 ps timing resolution. The MS3400 also tests a variety of other circuits, including circuits with buried memory, programmable array logic (PAL) and programmable logic devices (PLDs). The second member of the line, the MS3440, expands test capacity to 256M × 36 bits, along with other enhancements. The MS3440 is in production as of the first quarter of 1993.

**Current Marketing Activities**

MOSAID's Semiconductor Division leverages its unique circuit-design expertise through the licensing of its proprietary memory-chip designs to wafer-fabrication partners. These partnerships with some of the world's largest semiconductor companies provide MOSAID with the unique opportunity to offer systems customers memory-intensive custom chips based on the combination of MOSAID design capability and the advanced processes and economies of scale of the world's most advanced wafer-fabrication facilities.

MOSAID's market-penetration strategy for ATE has been to sell each generation of test system to an ever-widening application niche. This strategy will be continued.

In addition to sales headquarters in Santa Clara, California, the company has a worldwide distributor network. The company participates in key industry trade shows on three continents, supports ongoing training for customers and distributors, and maintains a selective media advertising program.

**Collaborative Arrangements Sought**

MOSAID Technologies is interested in collaborating with companies directly involved in the manufacturing of semiconductor products or with capital-asset suppliers to such manufactures.

MOSAID would consider a range of relationships: joint marketing arrangements, manufacturing licensing agreements, joint ventures and minority-interest positions.

# NEWBRIDGE MICROSYSTEMS

603 March Road
Kanata, Ontario
Canada K2K 2M5

**Telephone: (613) 592-0714**
Fax: (613) 592-1320

**Contact:**
Dr. Adam Chowaniec, President

Newbridge Microsystems is a division of Newbridge Networks Corporation. Newbridge Microsystems designs, manufactures and sells semiconductor components and related OEM board-level telecom products, including a range of encryption devices.

Newbridge Microsystems has the strong CMOS IC design capability and the necessary expertise to provide upward integration to higher level OEM board-level subsystem solutions.

### Major Achievements

- Newbridge Microsystems has achieved a leading position in open bus (VME and Futurebus+) product developments.
- Newbridge Microsystems has a 600-page product catalogue.
- Newbridge Microsystems has launched a range of VME-TI cards.

### Profile

| | |
|---|---|
| Sales Volume: | $6 to 8 million |
| Employees: | 40 people |
| Key Customers: | The company has a very broad customer base because of its 8000-series and open bus product lines |

### Background

To provide OEMs with this proven telecom technology and to provide Newbridge Networks with key IC design and manufacturing capability, Calmos Semiconductor was acquired in 1989 and the Newbridge Microsystems division was formed.

Founded in 1986, Newbridge Networks is today one of the fastest growing digital wide area networking companies in the world, with 1992 revenues of $181 million. Newbridge Networks' major strengths are in T1 and T3 high-speed digital wide-area networks (WANs), and to date more than 20 000 T1 and T3 multiplexers have been shipped worldwide.

### Business Description

In addition to a range of standard CMOS microprocessor and peripheral products, Newbridge Microsystems provides open bus solutions.

Newbridge Microsystems currently supplies VME-32/VME-64 interface devices and is developing Futurebus+ protocol and arbitration ICs to further speed the acceptance of Futurebus+ and VME/Futurebus Extended Architecture (VFEA). These ICs are intended for general purpose use with VFEA. Desk Top Futurebus+ and other Institute of Electrical and Electronics Engineers (IEEE) P896-compliant profiles are supported by VHDL models. These protocol chip sets will relieve board designers of the task of ensuring line-by-line compliance with the Futurebus+ specification. In this way an interface to an open bus can be achieved simply and effectively with off-the-shelf chips. This speeds the acceptance of open architectures among those who have traditionally favoured proprietary bus architectures.

In the area of digital communications, Newbridge Microsystems is developing a range of VME-T1 E1 digital trunk interface OEM board-level, development-system-level and device-level products.

As the Futurebus+ market gains momentum, Newbridge Microsystems intends to provide Futurebus+ OEM board-level telecom products that will complement boards offered by other members of the Futurebus+ community. Many of these OEM board-level products are created by coupling proven Newbridge communications technology with high-performance open bus VME and Futurebus+ chip sets, including the recently announced VME-T1 WAN card. As new high-speed transmission standards emerge (FDD, SONET, T3, etc.) the requirement for higher throughput open bus standards is becoming increasingly important and is driving the development of the next generation of chip sets at Newbridge Microsystems.

Newbridge believes that VME-64 and Futurebus+ will be popular platforms for these higher speed protocols and standards and that these WAN card-level products will gain widespread acceptance among systems integrators and computer manufacturers.

Recognizing that data security is seriously threatened as businesses, military establishments and universities become interconnected via a web of local-area networks (LANs), networks and modems, Newbridge Microsystems has developed a range of data-security chip-level, development-system-level, and OEM board-level products, based on Data Encryption Standard (DES) and public-key encryption technology.

This division has a policy of acting as both a licensee and a licensor of semiconductor devices. Currently, for example, the company has licensed VME devices from Dy 4 Systems Inc. of Canada and AES/EBU devices from the British Broadcasting Corporation. Newbridge Microsystems has licensed 8000-series peripheral and microprocessor devices to more that 10 companies worldwide.

**Current Marketing Activities**

Newbridge Microsystems has sales representatives worldwide.

**Collaborative Arrangements Sought**

Newbridge Microsystems is interested in the following:

- Technology exchanges.
- OEM component and board sales.

# NORTHERN TELECOM SEMICONDUCTOR COMPONENTS GROUP

185 Corkstown Road
Nepean, Ontario
Canada K2H 8V4

**Telephone: (613) 763-4425**
Fax: (613) 763-8339

**Contact:**
Dr. Claudine Simson,
Director, Technology

The Semiconductor Components Group (SCG) produces advanced electronic components for various divisions of Northern Telecom Limited — the world's leading supplier of fully digital telecommunications equipment.

SCG's mandate is to develop and implement process technologies needed to fabricate custom components such as silicon microchips, GaAs ICs, and optoelectronic modules. SCG has plants in Canada, the United States and the United Kingdom.

**Major Achievements**

- Production of highly specialized custom silicon chips for use in supernode/digital multiplex switch (S/DMS) switching systems and Meridian Norstar key systems.
- Implementation of a 0.8 micron bipolar complementary metal-oxide semiconductor (BiCMOS) process that marries low-power CMOS with the higher voltage and current capabilities of bipolar structures.
- Extensive support for university cooperative interaction programs and active participation in federal and provincial government-funded centres of excellence (e.g., TRIO, MICRONET, ITRC, OCMRI).
- World leadership in providing IC microsurgery services to accelerate new-product introductions and reduce manufacturing costs.

**Background**

Northern Telecom Limited's Semiconductor Components Group has operations in Canada, the United States and the United Kingdom and produces advanced custom electronics for application in telecommunications systems.

SCG's mandate is to develop and implement the process technologies needed to fabricate a variety of custom electronic components, including silicon microchips, GaAs devices, optoelectronic modules and microchip packages. SCG's electronic components embody critical proprietary hardware technology and provide the rest of Northern Telecom with a competitive edge by increasing the functionality, processing speed, and intelligence of the telecommunications systems they produce.

The ability to fabricate advanced custom components also enables our Northern Telecom customers to achieve overall product-cost reductions, since fewer circuit boards and other components are needed to deliver the desired functionality. SCG components are used in a variety of systems, including digital switches, private branch exchanges, telephone sets, and transmission products.

SCG employs more than 900 people at its 46 450 $m^2$ semiconductor technology and manufacturing facility on a 28 ha campus-like setting in Nepean, Ontario, near Ottawa. This complex contains Canada's largest and most advanced clean room for the fabrication of extremely powerful custom semiconductors. Circuit features of these microchips are ≤1 micron (one thousandth of a millimetre) in width.

SCG specializes in the production of sophisticated semiconductors custom-designed for telecommunications applications — devices not readily available from other suppliers. Such devices may contain, for example, a variety of embedded memory circuits, circuitry for processing analogue (voice) signals, and digital circuitry for executing logical instructions or converting analogue signals into streams of digitized data.

SCG maintains its leadership role in custom semiconductors for telecommunications by continuously developing new generations of appropriate process technologies for fabricating increasingly complex devices. A case in point is the recent implementation of a bipolar analogue telecom-enhanced metal-dioxide semiconductor (BATMOS), a 0.8 micron BiCMOS process technology that marries the lower energy consumption of CMOS with the higher voltage and current capability of bipolar structures. Microchips made through the BATMOS process could contain several million transistors and furnish a variety of telecommunications-oriented features, including high-speed bipolar, medium-voltage bipolar analogue circuits, embedded DRAM and SRAM memory, and programmable memory. Northern Telecom products incorporating these "super chips" will have a major impact on the global telecommunications marketplace.

# NovAtel

1020-64th Avenue N.E.
Calgary, Alberta
Canada T2E 7V8

**Telephone: (403) 295-4548**
Fax: (403) 295-5060

**Contact:**
Mr. Graham Purves

NovAtel Communications Ltd. is Canada's only designer and manufacturer of cellular telephones and wireless communications products. Based in Calgary, Alberta, Canada, the company has sales offices and distribution centres in Fort Worth (Texas), Mississauga (Ontario), Montreal (Quebec), Wanchai (Hong Kong) and Wilshire (United Kingdom). NovAtel employs more than 700 people in its various research, development, manufacturing and sales offices worldwide.

**Major Achievements**

NovAtel's cellular telephones and wireless products are designed using the latest in computer-aided design (CAD) and computer-aided engineering (CAE) equipment. The company has more than 75 issued or pending patents that were developed in-house specifically for NovAtel products.

NovAtel's R&D personnel will soon complete the development of digital and dual-mode cellular technology. The company participated in several phases of the Cellular Telecommunications Industry Association lockdown process to establish the standards for North America's time-division multiple-access protocol.

Over the years, NovAtel has received many awards for its contributions to technology and business. The company received its first Canada Award for Business Excellence Gold Award in 1987 in the Industrial Design category for the 8300/9300 product family. NovAtel received Alberta Export Achievement Awards in both 1988 and 1987 and was the winner of a Canada Export Award in 1988.

**Company Background**

NovAtel was formed in 1983 as a joint venture between NOVA Corporation of Alberta and Alberta Government Telephones. In May 1992, NovAtel was sold to Telexel Holding Ltd., a private Alberta company formed to purchase NovAtel. The shareholders have seasoned manufacturing and marketing experience in the Asian and European markets.

**Business Activities**

During its nine years of operation, NovAtel has achieved a significant position in the wireless industry. The company has a full line of cellular telephones and accessories and is a leading supplier in Canada, the United States and the United Kingdom. Its stand-alone cellular system, the SCS-Libra™, provides innovative solutions for emergency response and a variety of difficult coverage applications. NovAtel's most recent wireless product is its Global Positioning System, which offers industry leading accuracy and performance levels.

In addition, NovAtel is an OEM of cellular telephones and wireless products for a number of companies in the United States, the United Kingdom and Canada. NovAtel's OEM clients include IBM and Motorola.

With more than 95% of its product exported out of Canada, NovAtel has dealers and agents in the United States, Latin America, South America, Europe and the Far East.

**Current Marketing Activities**

The company's R&D expertise is supplemented by state-of-the-art manufacturing techniques that use COB and robotics technologies. In 1989, NovAtel launched a $7 million expansion of its Lethbridge, Alberta facility. The facility, completed in the summer of 1990, now has 7 060 $m^2$ of manufacturing area. Soon the company will re-open its 10 220 $m^2$ manufacturing facility in Calgary. This computer-integrated manufacturing facility, "Cimplex", will produce the next generation of NovAtel's advanced wireless products.

# OPTO-ELECTRONICS INC.

2538 Speers Road, Unit 9
Oakville, Ontario
Canada L6L 5K9

**Telephone: (416) 827-6214**
Fax: (416) 827-6216

**Contact:**
Dr. Brian Garside, President

Opto-Electronics Inc. is the original manufacturer of the world's fastest picosecond–gigahertz photodetectors and diode laser sources. Established in 1976, the company has become one of the leading fibre-optic test- and measurement-instrument manufacturers in the world.

Opto-Electronics' first product, the PD10 picosecond photodetector, was introduced in 1979. This detector was the fastest commercially available device at that time and was the forerunner of an ever-expanding line of fibre-optic test and measurement instrumentation. Today our products range from ultrafast fibre-optic receivers and transmitters to signal-processing instruments and systems, such as the unique millimetre-resolution optimum time-domain reflectometer (OTDR) and the multi-gigahertz bandwidth tester.

**Product Capabilities**

The initial company product line consisted of a series of ultrafast photodiode detectors and semiconductor diode laser sources for use at visible and near-infrared wavelengths. These devices were produced as stand-alone scientific instruments, complete with power supplies, microwave circuitry and an optical mounting system. They were designed to respond on a time scale of tens to hundreds of picoseconds. These sources and detectors, now available as plug-in units in a rack-mountable mainframe system, can provide customized general-purpose test instrumentation. In addition, this mainframe system, in conjunction with specialized high-speed electronic processors, is configured as special-purpose test and measurement systems. Two systems are currently available; more are planned.

One of the current systems, based on the FPS10 Fourier processor, measures optical-fibre bandwidth and pulse dispersion. The other, based on the TDR10 processor, is designed for millimetre-resolution OTDRs. The latter system was cited by *Photonics Spectra* as one of the "25 best new products of 1988."

**Markets Served**

Opto-Electronics Inc. is a major worldwide supplier of high-speed fibre-optic test and measurement instrumentation. Our clients are leading high-technology companies and laboratories involved in military, commercial and industrial applications. The company product line is based on the ability to generate and detect picosecond optical pulses as well as to design and manufacture the necessary high-speed signal-processing electronics to take full advantage of this highly specialized capability. Major markets are in the characterization of short-haul optical-fibre local-area communications, multisensor networks, and fibre-optic component analysis.

Opto-Electronics sells its product line throughout the world and has official representation in many countries.

# OPTOTEK LTD.

62 Steacie Drive
Kanata, Ontario
Canada K2K 2A9

**Telephone: (613) 591-0336**
Fax: (613) 591-0584

**Contacts:**
Dr. David Kennedy, President

Mr. P. Gunnor Wareberg,
Vice-President, Operations

Mr. Randall B. North,
Director, R&D

Mr. David Girard,
Accounting Manager

Optotek designs and manufactures optoelectronic semiconductor components, subsystems and related software products for military and industrial applications. The company is known for its engineering expertise and sophisticated technology.

**Profile**

| | |
|---|---|
| Established: | 1977 |
| Sales Volume: | $2 to 3 million (65% exports) |
| Employees: | 30 people |

**Products**

Displays

- Red, green, blue, yellow, orange.
- Linear light-emitting diodes (LEDs) with resolutions to 1 000 dots per inch (dpi) for printing applications.
- LED recording-head displays for airborne reconnaissance applications.
- Printheads for electronic printing presses (Printstic).
- Matric LEDs for visual and film marking applications with resolutions to 100 dpi.
- Segmented numeric and alphanumeric displays.
- LED apertures of any desired shape for special symbols of reticles.
- LED uniformity compensation of grey scale.
- Integrated-drive electronics.
- Optical coupling or contrast enhancement.

Microwave Components

- GaAs field-effect transistors (FETs).
- GaAs application-specific monolithic microwave integrated circuits (MMICs).
- Miniature hybrid microwave integrated circuits (MHMICs).

Software

- Microwave linear design and analysis (MMICAD™).

**Business Description**

Optotek designs and manufactures application-specific GaAs MMICs for military and communications requirements, as well as high-resolution microwave integrated circuits (MICs).

The company has also developed and released for commercial sale its microwave computer-aided engineering software (MMICAD™) for design, analysis and test applications. This software is also suitable for specialized electronic design requirements in astronomy and nuclear science.

**Current Products**

- Customized LED displays.
- LED printheads.
- Associated drive electronics subsystems.
- Display test equipment.

**Marketing Activities**

- LED and GaAs MMIC products are supported through a combination of local representation, direct engineering sales support from home office, and selective "capability" advertising.
- The CAE software is supported by local representation and direct sales (telemarketing) complemented by extensive advertising.

Optotek has representatives in the United Kingdom, France, Germany, Israel and various parts of the United States.

**Principal Clients**

LED displays and GaAs MMICs: OEMs and large companies.

# PMC-Sierra, Inc.

8501 Commerce Court
Burnaby, British Columbia
Canada V5A 4N3

**Telephone: (604) 668-7300**
Fax: (604) 668-7301

**Contacts:**
Mr. Gregory Aasen, COO
Mr. Ralph Bennett, CEO

PMC-Sierra develops and markets chip sets and module-level products for asynchronous transfer-mode (ATM) transmission, switching and networking applications.

**Major Achievements**

- PMC is one of the leading companies in the development and supply of ATM, SONET and synchronous digital hierarchy (SDH) chips and modules for the merchant market.
- PMC has designed more than 25 ICs and seven multichip modules (MCMs) for communications-equipment manufacturers.
- PMC was the first company to market fully integrated T1 transceivers with integrated digital and analogue circuitry on the same chip.
- PMC has developed a telecommunications design library of more than 60 telecom-system blocks (TSBs). These have enabled PMC to develop new designs twice as fast as those done with traditional design methods.

**Profile**

| | |
|---|---|
| Sales Volume: | $6 million |
| Employees: | 33 people |
| Key Customers: | • Major telecommunications manufacturers |
| | • Major workstation/datacom manufacturers |

**Background**

PMC was created in 1988 to provide advanced chips and MCMs to the telecommunications industry. From 1988 to the end of 1991, PMC developed and sold its products in a strategic relationship with VLSI Technology, Inc.

By the end of 1991 PMC had developed a substantial customer base throughout North America and received its first orders from Europe and Asia. Japanese companies had also expressed a strong interest in PMC's products.

In mid-1991, PMC introduced its first standard product to the market place, a 622 Mbit/s SONET–SDH line interface module that was readily accepted in the marketplace. In 1992 PMC announced that it would be moving forward with its plans to bring standard products to the worldwide market directly and withdrew its support from VLSI Technology, Inc. for the joint development of ASIC-based products.

In 1992, PMC added to its standard product offerings and announced four additional standard products for ATM SONET and T1 applications. PMC also formed the Saturn Group to develop ATM chip sets for LAN applications. The Saturn Group consists of more than 20 computer and networking companies.

**Business Description**

PMC's business strategy is to provide high-performance products that support both LAN and WAN applications using ATM, SONET and SDH technology.

The network of the future will use fibre optics and be based on SONET–SDH and ATM standards for transmission and switching. PMC's chip sets and modules implement these standards, and its other products support existing transmission standards, such as T1, T3, E1, E2, E3 and E4.

As a "fabless" semiconductor company, PMC is free to chose the optimum integration technology from the most competitive source for a given IC design. PMC has 511 $m^2$ of clean-room facilities to package, test and qualify its products and has in-house capability for manufacturing MCMs. PMC has also developed several strategic business relationships with other companies for the co-development and manufacture of circuits.

**Current Marketing Activities**

PMC's products are sold worldwide through a sales network consisting of internal sales staff and sales representatives throughout North America, Europe, Asia and Japan. PMC has a well-established international customer base, and more than 90% of its products are sold to the export market.

**Collaborative Arrangements Sought**

- VLSI Technology, Inc. has a licence to second-source several of PMC's standard products.
- AMCC and PMC have signed an agreement to jointly develop two high-speed circuits for use in SONET–SDH networks.

# PRIMETECH ELECTRONICS INCORPORATED

275 Kesmark
Dollard-des-Ormeaux, Quebec
Canada H9B 3J1

**Telephone: (514) 421-0023**
Fax: (514) 421-1241

**Contacts:**
(Montreal) Mr. J.J. Myette,
Vice-President, Corporate Affairs

(Granby) Mr. Rick O'Brien,
Executive Vice-President

Through innovative design capabilities, quality management and cost-effective manufacturing, Primetech develops electronic products for worldwide distribution.

Three facilities take a customer's product requirement through design, packaging, PCB- and MCM-level manufacturing, to systems assembly up to and including final tests.

**Major Achievements**

- Primetech has gone beyond contractual manufacturing to being considered a partner in business by it's customers.
- Primetech's quality management uses 6-sigma programs. Our customers are world leaders in microelectronic manufacturing.

**Profile**

| | |
|---|---|
| Sales Volume: | $17 million |
| Employees: | 400 people |
| Key Customers: | Apple Computer |
| | Bell Canada |
| | Bombardier |
| | Department of National Defence |
| | D.S.L. |
| | Elcombe |
| | General Electric |
| | IBM |
| | Newbridge Networks |
| | Northern Telecom |
| | Oerlikon Aerospace |
| | Pratt & Whitney |
| | Securiplex |
| | Spar |
| | Sun Microsystems |
| | United Technology |
| | Via Rail |

**Background**

Primetech is the consolidation of several acquisitions made over the last 16 years by Tech-Rep Electronics Inc.

Primetech's headquarters is in Montreal. In its 4 545 $m^2$ facility, 175 employees handle marketing, engineering, manufacturing and assembly of PCBs, systems tests, cable assemblies, software development, product development and manufacturing. Primetech undertakes these activities in partnership with some of the above-mentioned customers.

Primetech (Granby) is a facility of 2 785 $m^2$, 33% of which is certified clean rooms. The 200 employees at Granby inspected and produced more than 15 000 000 MCMs last year.

Tech-Rep Europe, Primetech's European facility of 1 020 $m^2$ and 30 employees, manufactures products for the aviation industry.

**Business Description**

Primetech's present activities comprise the following:

- LANs.
- Data communication over a radio-frequency (RF) link.
- Time-division-multiplexed audio and data communication.
- Real-time software development.
- Field-service instruments for electro-mechanical system's diagnosis.
- Lightning and power-line surge simulation and protection.
- Switching power supplies.
- High-volume consumer products.
- Sub-manufacturing of ceramic MCMs.
- Inspection and quality acceptance of MCMs to 6-sigma quality levels.
- Data analysis of inspection results and compilation of SPC charts.
- Real-time embedded systems.
- electromagnetic interference (EMI) and radio frequency interference (RFI) control.
- RF systems up to 1 GHz.
- Medical electronics.

**Collaborative Arrangements Sought**

Primetech is interested in strategic partnerships with world-class manufacturers.

# Process Technology Limited

286 Restigouche Road
Oromocto, New Brunswick
Canada E2V 2H5

**Telephone: (506) 446-5200**
Fax: (506) 446-5206

**Contact:**
Mr. R.B. (Rick) DesBrisay,
President

Process Technology Limited (PTL) designs and manufactures semiconductor manufacturing equipment for low-pressure chemical-vapour deposition (LPCVD) systems.

**Major Achievements**

- PTL developed and patented a LPCVD system used by major semiconductor manufacturers around the world.
- PTL developed and patented a post-reaction chamber (PRC) for scrubbing hazardous gases from the exhaust lines of semiconductor processing equipment.
- PTL has developed a unique system for conducting plasma-enhanced CVD. A U.S. patent is pending on this product.
- PTL won the Canada Award for Business Excellence in Entrepreneurship in 1986.

**Profile**

| | |
|---|---|
| Sales Volume: | $2 million |
| Employees: | 15 people |
| Key Customers: | Motorola |
| | IBM |
| | AT&T |
| | Gennum |

**Background**

The company was established in 1982 by a former employee of Northern Telecom. The founder obtained a licence from Northern for a process that deposits thin films on semiconductor wafers. The company has since then made several significant improvements to the original product and broadened the product line. The company has it's 1 672 $m^2$ office and manufacturing facility in Oromocto, New Brunswick.

The company has a class-100 clean room where it conducts wafer processing and research.

**Business Description**

PTL's products and services include the following:

- Semiconductor quartzware.
- PRC, a device that acts as a scrubber to remove virtually all of the toxic and hazardous gases from the exhaust stream of low-pressure and plasma-enhanced chemical deposition systems (the PRC not only protects the environment but also provides the user with a fast payback, reducing the cost of ownership of CVD equipment).
- Remanufactured LPCVD systems, including complete furnace systems.

**Current Marketing Activities**

The company distributes its products directly, but it employs sales agents in 10 countries outside Canada.

PTL attends semiconductor industry trade shows in the United States, Japan, Europe and China.

**Collaborative Arrangements Sought**

- Access to, or licensing of, semiconductor CVD technology.
- Joint ventures for semiconductor processing equipment, technology and systems.
- Joint ventures for R&D of semiconductor processing systems.

# SEMICONDUCTOR INSIGHTS INC.

P.O. Box 130
Stittsville, Ontario
Canada K2S 1A2

**Telephone: (613) 831-6118**
Fax: (613) 831-5001

**Contact:**
Dr. Doug Smeaton, President and CEO

Semiconductor Insights (SI) is a microelectronics engineering consulting firm. SI specializes in a) the analysis of circuit-design techniques and technology used in semiconductor devices and b) the technical analysis of semiconductor patents. In addition to a broad range of custom services covering essentially any type of IC in any major manufacturing process, SI publishes an ongoing series of design analysis and structural analysis reports on state-of-the-art memory devices.

**Major Achievements**

SI has provided technical support for some of the largest patent licensing programs in the semiconductor industry.

With its extensive technical library, detailed files on memory IC circuitry and inventory of more than 1 100 different memory ICs, all dating back to 1975, SI is the largest independent source for design information on memory circuits.

Through its network of relationships across North America, SI is now able to offer its customers advanced laboratory services such as focused ion beam microsurgery and scanning probe microscopy, as well as full materials analysis.

SI's TQM process, introduced in 1992, has already produced a 50% reduction in the development time for design analysis reports.

**Profile**

| | |
|---|---|
| Sales Volume: | $3 million (1992) |
| Employees: | 32 people |
| Customers: | Major semiconductor and systems companies, as well as intellectual property law offices, in the U.S. Pacific Rim and Europe |

**Background**

Semiconductor Insights was formed as an independent company in July 1989, but it traces its origins back to 1975 to the Technical Services Group of MOSAID Technologies Inc., a leader in IC memory design and test systems.

**Current Marketing Activities**

SI's services include the following:

Design Analysis and Structural Analysis Reports

- Extensive reviews of the circuit design and manufacturing process techniques used in state-of-the-art semiconductor memories.
- Special interest reports studying design or technology issues or providing comparative analyses of a number of different devices.

Custom Design Analysis

- Full customer-specific services supporting detailed competitive product analyses, intellectual property activities, technology evaluation, or product liability claims.
- Sample or system procurement, generation of device schematics, circuit design and functional analysis, firmware code extraction, structural or materials analysis, and process technology analysis.

Intellectual Property Services

- Patent reviews and ratings.
- Comparison of patents to circuit or process structures.
- Claim-by-claim patent analysis and documentation.
- Prior art searches.
- General technical support during licensing and litigation.
- Independent design assessments.
- Special training programs for technical staff.

SI has been very successful in the U.S. market and is currently investing in the expansion of its customer base in Japan, Korea, Taiwan, China and Europe.

**Collaborative Arrangements Sought**

- Relationships with companies that have advanced facilities for semiconductor materials analysis.
- Technical collaboration with companies interested in developing the technology associated with automated design analysis of complex, state-of-the-art ICs (this includes electronic die image capture, processing and display, and linkage to CAD tools for the automated extraction of layout and circuit information).

# SILCOM RESEARCH LIMITED

308 Palladium Drive, Suite 201
Kanata, Ontario
Canada K2V 1A1

**Telephone: (613) 591-1342**
Fax: (613) 591-1329

**Contact:**
Mr. J. Peter Williams, President

Silcom Research Limited (SRL) is a modern R&D company specializing in advanced wireless communications equipment and products for portable, mobile or fixed application. SRL develops these products from concept to production engineering, taking care of all aspects of the process from designing custom silicon to industrial design and packaging. SRL has been built around its ability to perform complete product development including silicon, software and mechanical design.

**Major Achievements**

- SRL has designed a complete radio-paging receiver for digital- alphanumeric services.
- SRL has developed a high-speed optical data interface IC.
- SRL has developed a very low-power 1 GHz radio.
- SRL has developed a 0.8 micron CMOS digital-data signal-processing and system-support IC for radio-paging applications.
- SRL has established a joint venture with a major North America telecommunications company.

**Company Profile**

| | |
|---|---|
| Sales Volume: | $1.25 million (forecast 1992–93) |
| Employees: | 8 people |
| Key Customers: | The nature of its work with major corporations in developing custom product solutions requires SRL to keep those relationships confidential. References on a case-by-case basis can be made available |

**Company Background**

SRL was founded in 1989 to provide communications operating companies with complete solutions for their own unique marketing plans. The founders have strong R&D and business backgrounds in the development, production and marketing of ICs, digital radio-paging products, and wireless systems.

**Business Description**

SRL's current products and services include the following:

- Low-power radio ICs.
- Advanced messaging radio-paging receivers.
- Custom engineering services.

SRL's engineering team develops core enabling technologies that can be used to generate complete marketing solutions for its customers' needs. The technology blocks are used together with the wide range of SRL's engineering skills to take a customer's "wish list" from the concept stage to production.

Working from customer specifications, SRL designs radio frequency (RF) ICs for a wide variety of different types of radio systems. These include direct conversion, superhethrodynes, low-power transmitters and novel radio systems. Because it also builds radio systems, SRL understands the need for precisely defined functions to minimize components, volume, power and costs.

SRL offers assistance in selecting primary and prospective second-source vendors and can provide ongoing support in production engineering. SRL's senior engineering staff has a long track record of successful and innovative IC design. Design tools include state-of-the-art simulation and CAD facilities.

Typically, following device partitioning and specification, SRL will design detailed schematics and verify the design using either sales-point information computing equipment (SPICE) simulation or breadboarding or both. The IC is laid out on a CAD system using design specifications of the target silicon vendor. The layout design is verified using both detailed manual checking and automatic design rule checking.

SRL will develop individual semiconductor components or, if required, can develop complete systems, including custom silicon, to optimize the design and cost criteria. The use of surface-mount devices (SMDs) is an integral part of the design process required for the development of very small-profile products.

**Current Marketing Activities**

SRL's current marketing thrust is through corporate joint ventures in Canada, the United States, and Europe.

**Collaborative Arrangements Sought**

SRL is interested in establishing the following:

- Contracts or joint ventures with communications operating companies to provide unique product solutions for use on their networks.
- Agreements with distribution companies to market SRL products and services.

Arrangements of the types above can include generous exclusive marketing rights to provide incentives for SRL partners.

# SILONEX INC.

2150 Ward Street
Montreal, Quebec
Canada H4M IT7

**Telephone: (514) 744-5507**
Fax: (514) 747-3906

**Contact:**
Mr. Alex Kalil, President
and CEO

Silonex specializes in the design, manufacture and marketing of opto-electronic devices. Its products range from photoconductive cells, LED/lamp photocell modules, and silicon photodiodes to photovoltaic cells. Silonex has a custom capability in design, prototyping and manufacture of custom optoelectronic components, including emitter detector interruptor type products.

**Profile**

Sales Volume: $5 to 15 million (95% exports)

Employees: 130 people

**Background**

The firm was founded in 1958 and is Canadian-owned. It executive and administrative offices and its manufacturing and R&D facilities are in Montreal.

**Business Description**

Product applications include industrial and commercial controls, ambient-light detection, monitoring systems, beam breaking and counting, optical isolation, encoding, medical electronics, avionics, security controls, industrial processes, money recognition, cameras and automotive controls.

**Current Marketing Activities**

Silonex markets its products through agents, manufacturers' representatives, and direct company representatives in North America, the United Kingdom, Europe and Far East. Silonex has also established sales and distribution facilities in the United Kingdom and the United States.

**Collaborative Arrangements Sought**

Silonex is interested in exploring inward investment, strategic alliances, and market penetration.

# SPECTRUM SIGNAL PROCESSING INC.

8525 Baxter Place
100 Production Court
Burnaby, British Columbia
Canada V5A 4V7

**Telephone: (604) 421-5422**
Fax: (604) 421-1764

**Contact:**
Mr. Barry Jinks, President
and CEO

Spectrum Signal Processing is a Canadian company specializing in DSP hardware and software products. The majority of Spectrum's revenue stems from PC and VME board-level products for product development and OEM applications. Spectrum's R&D activities are in three key areas:

- DSP array processing and imaging.
- Multimedia.
- Embedded control.

**Major Achievements**

- Spectrum is the largest supplier of third-party DSP development boards in North America.
- Spectrum developed Media-LINK™ interprocessor communication products.
- Spectrum develops MWAVE multimedia products.
- Spectrum is the exclusive North American licensor of U.K.-based Loughborough Sound Images products.
- Spectrum is the licensor and manufacturer of the VASP™ array processor from MacDonald Dettwiler and Associates (MDA).
- Spectrum won the 1992 B.C. Export Award.

**Company Profile**

| | |
|---|---|
| Sales: | $8.4 million (95% exports) |
| Employees: | 40 people in Canada and the United States |
| Key Customers: | Department of Defense (United States) |
| | Hewlett-Packard |
| | Topometrix |
| | Industrial Dynamics |
| | E-Systems |
| | Raytheon |
| | MacDonald Dettwiler and Associates |
| | Schlumberger |

**Company Background**

Founded in 1987, Spectrum Signal Processing signed an exclusive agreement for North American distribution and manufacture of Loughborough Sound Images products. In 1989, Spectrum formed an internal R&D department concentrating on the integration of multiple DSP and other processing technologies. The first products developed included the DSP/PC, integrating a PC 386 and a DSP connected by a proprietary high-speed Media-LINK™ communication channel; and a multiprocessor DSP system using the Media-LINK™ technology for imaging and video processing. The company is expanding in the areas of multimedia systems and embedded control systems.

Spectrum has been profitable for the past three years. Spectrum is headquartered in Burnaby, British Columbia, and has sales offices in Westborough, Massachusetts, and Mountain View, California. In 1993, Spectrum will open sales offices in the Washington, DC, and Austin, Texas, areas.

**Business Description**

Spectrum's major product lines are the following:

PC-based DSP boards

- Spectrum offers a variety of PC-based plug-in boards incorporating the latest and most popular general-purpose DSP devices in novel architectures targeted for specific applications, including test and measurement, industrial control, professional audio, communications and graphics processing.

Workstation-based DSP boards

- Spectrum offers a variety of VME and Sbus boards incorporating the latest and most popular general-purpose DSP devices in novel architectures targeted for specific applications, including radar and sonar, signal intelligence, communications and video processing.

Media-LINK™ family

- Spectrum offers a family of Media-LINK™ products integrating DSP devices with a variety of other processor technologies (complex instruction-set computer (CISC) and RISC) and high-speed peripherals. These products are based on the internally developed and marketed Media-LINK™ controller chip, which is novel architecture for interprocessor communication and networking targeted for specific applications such as desktop array processing, multimedia, imaging and remote sensing.

**Marketing**

Spectrum has an experienced direct sales team as well as representative agreements in California, Canada, Europe, Taiwan and Australia. Marketing activities include print advertising, vertical trade shows, direct mail, and various press activities.

Spectrum currently licenses products from Loughborough Sound Images, Microtel Pacific Research and MDA. Spectrum has OEM arrangements with several major U.S. companies, including Hewlett-Packard, E-Systems and Park Scientific.

**Collaborative Arrangements Sought**

- Distribution channels in Asia for our Media-LINK™ family and internal multimedia initiatives.
- North American rights for distribution and manufacture of DSP-related products developed in Asia and Europe.
- Cooperative R&D projects in multimedia and (or) video-signal processing.

# TASK MICROELECTRONICS INC.

1603 St. Regis Boulevard
Dollard-des-Ormeaux, Quebec
Canada H9B 3H7

**Telephone:**
**(514) 685-Task (8275)**
Fax: (514) 685-7611

**Contacts:**
Mr. Nick Tasker, President

Mr. Andrew Proudfoot,
Director, Engineering

Task is a specialist in the field of electronics packaging with an emphasis on extreme miniaturization. The company designs, develops and manufactures microelectronics assemblies, specializing in sophisticated thick-film hybrids, complex surface-mount assemblies, "chip-and-wire" assemblies, and flexible circuit techniques.

The company is built around substantial technical experience in the microelectronics industry. In addition to its manufacturing services, its capabilities extend outward to encompass electronics design and development (both hardware and software). The introduction of specific strategic products is envisaged to complement its current mandate and further add stability to the business.

**Major Achievements**

Through superb technical skills and impeccable quality, Task has established itself in only five years as one of the finest electronics packaging companies in North America, witnessed by a wide range of major international clients.

**Profile**

| | |
|---|---|
| Sales Volume: | <$5 million |
| Employees: | More than 40 people |
| Key customers: | Augat Communications |
| | Bell-Northern Research |
| | EG&G |
| | Gandalf |
| | G.E. Aerospace |
| | ITT Aerospace Communications |
| | L.M. Ericsson |
| | Litton |
| | NCR |
| | Northern Telecom Canada |
| | RCA |
| | Siemens |
| | Teradyne |

**Background**

Task was incorporated in December 1987 and comprises choice personnel from Montreal's two former hybrid microelectronics companies, which closed down within 18 months of each other. A substantial group of well-experienced technical and administrative personnel became available, bringing with them both individual and collective reputations.

**Business Description**

Services currently offered to military, aerospace, medical, telecommunications, computer and industrial markets are the following:

- Electronics design, both hardware and software
- Design, development and production
  - Complex thick-film hybrids
  - Surface-mount and mixed-technology boards
  - Flexible circuit assemblies
  - COB assemblies
  - Chip-on-flex assemblies
  - Various combinations of the above

Task has become a specialist in the packaging of electronics, particularly in those cases where extreme miniaturization is required, together with the utmost in quality and reliability.

Novel techniques and processes are constantly in development to offer state-of-the-art solutions to electronics packaging.

**Current Marketing Activities**

Task has two chief marketing thrusts:

- The steady increase in export sales of current capabilities to the United States through wider geographical coverage.
- Specialization in the medical electronics field where the company's strengths in both miniaturization and superlative quality may both be profitably applied.

**Collaborative Arrangements Sought**

- Task is seeking partners with whom to develop innovative products, particularly with those involved in marketing and distribution to non-consumer markets (with Task's substantial entry into the medical electronics arena, this would be the market of choice; however, Task currently supplies to most industries).
- Task would be interested in finding European partners for whom to manufacture in North America, using similar technologies and capabilities.

# TECHWARE SYSTEMS CORPORATION

100-12051 Horseshoe Way
Richmond, British Columbia
Canada V7A 4V4

**Telephone: (604) 271-2000**
Fax: (604) 275-8572

**Contact:**
Mr. Martin Hanssmann,
International Sales Manager

**Europe Office:**
1st Floor
Aztec Centre, Aztec West
Almondsbury, Bristol BS124TD
United Kingdom

**Telephone: (0454) 614085**
Fax: (0454) 614700

Techware Systems Corporation is a leading supplier of real-time industrial-control solutions to the semiconductor and high-vacuum industries. Techware focuses on providing complete, integrated solutions that include control-engineering expertise, a complete line of flexible hardware and software products, installation, applications programming, controls integration, technical support and training.

**Major Achievements**

- Techware has developed a family of unique generic control products and controls-integration expertise specifically designed for semiconductor and thin-film-process industries.
- Techware has designed the only cluster module controller that can be used on a variety of equipment vendor process or transport/cassette modules within cluster tools.
- Techware has the capability to support its customers worldwide via modem with a remote modem support package.
- Techware was the first Canadian company to become a member of the U.S. Semiconductor Research Corporation (SRC), which subsequently opened the door for other Canadian company memberships and Canadian government participation. Techware hosted an SRC Workshop on Real-Time Tool Controllers in Vancouver in February 1991.
- Techware is an active participant on the Semiconductor Equipment and Materials International (SEMI) Modular Equipment Standards Committee (MESC) and Recipe Management Task Force (RMTF).
- Techware was presented with a B.C. Export Award in 1990 for outstanding achievement in export. Techware currently exports 95% of its products and services to European, North American and Asian markets.

**Profile**

| | |
|---|---|
| Sales Volume: | $3 million |
| Employees: | 25 people |
| Key Customers: | IBM<br>Motorola<br>Intel<br>Hewlett-Packard<br>Honeywell<br>Digital Equipment Corp.<br>Xerox<br>Bell-Northern Research semiconductor manufacturers in the United States and Europe |

**Background**

Techware Systems Corporation is a private company founded in 1983 by a process engineer who envisioned the development of a flexible, high-quality automation system to improve the quality of thin-film processes by better process control. The original Techware controller was designed to control a reactive magnetron sputtering process. The first product formed the basis for the present

Techware family of process-equipment control systems. By taking into account customer feedback during product development, Techware controllers have become the industry leaders in superior performance and reliability for a wide variety of process applications. Techware is continually developing additional hardware components and software features to provide customers with new process-control technologies that will improve the quality of processing and adapt to evolving equipment standards.

**Business Description**

Techware's control products and controls-integration services include the following:

- A family of real-time controllers based on scalable hardware and real-time multitasking CONTROLVision™ software platforms
- Techware-II process-equipment controller
- TC-III controller
- Cluster module controller

Hardware interfaces for the above products include analogue, digital, relay and thermocouple I/O modules, RS-232/485 serial ports.

The CONTROLVision™ software is based on Techware's proprietary fourth-generation language (4GL) process automation language (PAL), which offers a rapid menu-driven development environment for creating and editing process programs, datalogs, recipes, batches and real-time operations display screens. In addition to PAL, CONTROLVision™ offers a library of software modules for I/O, recipe, alarm, data, control and custom services.

A selection of user interfaces (character-based or graphical colour graphics displays) and communications (serial, ethernet, SECSII and MESC services communications packages) is also available. A library of RS-232 drivers for third-party vacuum instrumentation has been developed and is continually expanding to meet customer demands.

Techware offers a full range of engineering, wiring, installation, applications programming, training and support services for custom controls integration worldwide.

**Current Marketing Activities**

In addition to a direct sales force, Techware uses sales representatives throughout North America, Europe (United Kingdom, France, Germany, Austria, Switzerland) and Korea. A trading company handles the distribution of Techware products in Japan.

A European office was established in Bristol, United Kingdom, in 1991 to provide European customers with local sales, installation, training, applications programming and support services.

**Collaborative Arrangements Sought**

- Representation of products and services in European and Asian territories.
- Joint product development.

# TIMESTEP ENGINEERING INCORPORATED

P.O. Box 72089
Kanata, Ontario
Canada K2K 2P4

**Telephone: (613) 820-0024**
Fax: (613) 591-8617

**Contact:**
Mr. Tim Hember

Timestep Engineering develops and markets semi-custom IC solutions for the computer security market.

**Major Achievements**

- Timestep has developed the CA95C68, a high-speed pin-compatible version of the popular industry-standard AMD Am95DES IC, to be marketed by Newbridge Microsystems.
- Timestep has developed an intelligent memory module to provide on-line firmware updates to existing LAN installations. This device is currently marketed by Lanworks Technologies.
- Timestep has developed a 155-bit modulus multiplier IC for public-key cryptographic applications currently being developed by the University of Waterloo.
- Timestep has developed a portable and scalable ASIC core implementing the National Bureau of Standards (NBS) DES, FIPS PUB 46 (1-15-1977), for integration into application-specific security solutions.

**Company Profile**

| | |
|---|---|
| Sales Volume: | $150 000 |
| Employees: | 1.5 people |
| Key Customers: | North American manufacturers of secure communication systems |

**Company Background**

Incorporated in March of 1991, Timestep's past and future success is rooted in the broad range of skills offered by its principals. Tim Hember, Tony Rosati and Brett Howard are experts in the fields of IC, subsystem and software design, particularly related to applications in cryptography. Timestep is a 100% Canadian, privately owned corporation.

**Business Description**

Timestep's core products include the following:

- The TSX DES core macro-cell for clients who wish to integrate DES into application-specific security solutions.
- A family of security-based ICs and MCMs including the CA95C68 industry-standard DES IC; the LAN-based access-control SmartROM; and the LAN-based encryption module LanDES.
- IC, board-level and software design services for security and cryptographic applications.

# TRL Microwave Technology Inc.

Suite 207 "Discovery Park"
3700 Gilmore Way
Burnaby, British Columbia
Canada V5G 4M1

**Telephone: (604) 430-4361**
Fax: (604) 430-3826

**Contact:**
Mr. Tae Ri (Terry), President and CEO

TRL Microwave Technology Inc. (TRL) is in the business of designing and manufacturing microwave communication and navigation products. TRL has established its R&D capability using state-of-the-art SMD, HMIC, MHMIC and MMIC technologies. TRL also has an in-house chip-handling process capability. The company has gained an excellent reputation as a leading GaAs MMIC design firm in Canada and maintains a close relationship with a number of U.S.-based MMIC foundries.

**Major Achievements**

- TRL was the prime contractor for phase 1 of the $5 000 000 Canadian Microwave Landing System (MLS) project (GaAs MMIC module development for phased-array antenna) of Transport Canada in 1988.
- TRL was awarded a $700 000 research contract in 1988 from the Canadian Department of National Defence to develop custom GaAs MMIC chips for military application.
- TRL was the prime contractor for phase II of the MLS project, with Canadian Marconi as a subcontractor, in 1989.
- TRL successfully developed and delivered a unique 2–18 GHz harmonic mixer for a near-field scanner application.
- TRL designed and developed a single-chip GaAs MMIC low-noise block converter (LNB) for direct broadcast satellite (DBS) application.
- TRL was awarded a contract in 1992 to design a medium-power K/Ka band transceiver for Communications Canada under the Space Industry Development Program (SIDP).

**Company Profile**

| | |
|---|---|
| Sales Volume: | $1.9 million (forecast 1993) |
| Employees: | 12 people |
| Key Customers: | Communications Canada |
| | Orbit Advanced Technologies Inc. (Israel) |
| | Transport Canada |

**Company Background**

TRL was founded as a private company in 1987 to research and develop innovative microwave products using the GaAs MMIC design firm in Canada. In 1992, based on its strong technical capabilities, TRL diversified into its own advanced product development and manufacturing for satellite, mobile and personal communications markets. TRL's present management has many years of proven experience in both commercial and defence areas.

**Current Marketing Activities**

TRL's marketing efforts have been mainly through direct contact with potential customers, including government. Once TRL establishes adequate manufacturing capability for the products by the end of 1992, it will expand marketing activity worldwide. This will include new offices, marketing agreements with local companies, and product advertisement.

**Collaborative Arrangements Sought**

TRL is interested in collaborating with companies who have a direct interest in or requirements for TRL's expertise or products. The companies may include the following:

- Large defence or space-system companies requiring advanced R&D.
- Communications or navigation companies requiring advanced product development.
- A major electronic manufacturer seeking a patentable, high-volume product manufacturing licence.

Such arrangements will include joint ventures and equity investment.

# List of Acronyms and Abbreviations

| | |
|---|---|
| AQAP | Allied Quality Assurance Provision |
| ASIC | application-specific integrated circuit |
| ATE | automatic test equipment |
| ATM | asynchronous transfer mode |
| BATMOS | bipolar analogue telecom-enhanced metal-dioxide semiconductor |
| BiCMOS | bipolar complementary metal-oxide semiconductor |
| CAD | computer-aided design |
| CAE | computer-aided engineering |
| CCD | charge-coupled device |
| CEO | chief executive officer |
| CEPT | Conférence européenne des administrations des postes et des télécommunications |
| CISC | complex instruction-set computer |
| CMC | Canadian Microelectronics Corporation |
| C-MDE | Concurrent Modular Design Environment |
| CMOS | complementary metal-oxide semiconductor |
| COB | chip-on-board |
| COO | chief operating officer |
| CPE | customer premise equipment |
| CQFP | ceramic quad flat pack |
| CVD | chemical-vapour deposition |
| DA | distribution amplifier |
| DAC | digital to analogue converter |
| DBS | direct broadcast satellite |
| DCA | direct chip attach |
| DES | Data Encryption Standard |
| DNIC | digital network integrated circuit |
| dpi | dots per inch |
| DRAM | dynamic random access memory |
| DSP | digital-signal processing |
| EDI | engineering design & inspection |
| EIA-J | Electronics Industries Association — Japan |
| EMI | electromagnetic interference |
| FET | field-effect transistor |
| FIPS | Federal Information Processing Standards (NBS) |
| FIR | finite impulse response |
| Fsc | frequency of subcarrier |

| | |
|---|---|
| GaAlAs | gallium aluminum arsenide |
| GaAs | gallium arsenide |
| 4GL | fourth-generation language |
| HDTV | high-definition television |
| HMIC | hybrid microwave integrated circuit |
| IC | integrated circuit |
| IEEE | Institute of Electrical and Electronics Engineers |
| ILB | inner lead bindings |
| InGaAs | indium gallium arsenide |
| InGaAsP | indium gallium arsenide phosphide |
| I/O | input/output |
| ISDN | integrated services digital network |
| ISO | International Standards Organization |
| ISTC | Industry, Science and Technology Canada |
| JEDEC | Joint Electron Device Engineering Councils |
| JIT | Just-in-Time |
| LAN | local-area network |
| LED | light-emitting diode |
| LNB | low-noise block converter |
| LPCVD | low-pressure chemical-vapour deposition |
| MC | metalized ceramic |
| MCM | multichip module |
| MDE | Modular Design Environment |
| MESC | Modular Equipment Standards Committee |
| MHMIC | miniature hybrid microwave integrated circuit |
| MIC | microwave integrated circuit |
| MIDI | musical instrument digital interface |
| MILSPEC | Military Specification |
| MLS | Microwave Landing System |
| MMIC | monolithic microwave integrated circuit |
| NBS | National Bureau of Standards |
| NTSC | National Television System Committee |
| OEM | original equipment manufacturer |
| OTDR | optical time-domain interference |
| PAL | phase-alternate-line |
| PAL | process automation language |
| PAL | programmable array logic |
| PC | personal computer |
| PCB | printed circuit board |

| | |
|---|---|
| PGA | pin grid array |
| PIN | positive–intrinsic–negative |
| PLD | programmable logic device |
| PRC | post-reaction chamber |
| PSRAM | pseudo-static random access memory |
| RAMDAC | random access memory digital analogue computer |
| R&D | research and development |
| RF | radio frequency |
| RFI | radio frequency interference |
| RGB | red green blue |
| RISC | reduced instruction-set computer |
| RMTF | Recipe Management Task Force |
| Sbus | SPARC bus |
| SDH | synchronous digital hierarchy |
| S/DMS | supernode/digital multiplex switch |
| SECSII | Semiconductor Equipment Communications Standard |
| SEM | scanning electron microscope |
| SEMI | Semiconductor Equipment and Materials International |
| SIDP | Space Industry Development Program |
| SMC | Strategic Microelectronics Consortium |
| SMD | surface-mount device |
| SONET | synchronous optical network |
| SPARC | scalable processor architecture |
| SPC | statistical process control |
| SPICE | sales-point information computing equipment |
| SRAM | static random access memory |
| SRC | Semiconductor Research Corporation |
| TAB | tape automated bonding |
| TDI | time delay and integration |
| TQM | total-quality management |
| TSB | telecom-system block |
| VFEA | VME/Futurebus Extended Architecture |
| VGA | videographics adaptor |
| VLSI | very large-scale integration |
| VTR | videotape recorder |
| WAN | wide-area network |

# ANNEX: CANADIAN MICROELECTRONIC NETWORK

**Applied Microelectronics Institute**
Dr. Doug Pincock, President
Applied Microelectronics Institute
1046 Barrington Street
Halifax, Nova Scotia
B3H 2R1
Tel.: (902) 421-1250
Fax: (902) 429-9983

**Alberta Microelectronic Centre**
John F. Zupanic, President
#318, 11315-87th Avenue
Edmonton, Alberta
T6G 2C2
Tel.: (403) 492-3914
Fax: (403) 492-1643

Tom Lambourne, Vice-President
Market Development
#200, 3553-31th Street N.W.
Calgary, Alberta
Tel.: (403) 289-2043
Fax: (403) 289-2047

**CADMI Microelectronics/ Microélectronique Inc.**
Eugene Lewis, Director
CADMI Microelectronics/
Microélectronique Inc.
University of New Brunswick Campus
P.O. Box 4400
Fredericton, New Brunswick
E3B 5A3
Tel.: (506) 453-3556
Fax: (506) 453-3589

Yves Doucet, Assistant Director
CADMI Microelectronics/
Microélectronique Inc.
Université de Moncton
Remi Rossignol Building, Room B215
Moncton, New Brunswick
E1A 3E9
Tel.: (506) 858-4153
Fax: (506) 858-4541

**Canadian Microelectronics Corporation**
Dr. Antony H. Marsh, President and CEO
Canadian Microelectronics Corporation
210A Carruthers Hall
Queen's University
Kingston, Ontario
K7L 3N6
Tel.: (613) 545-2914
Fax: (613) 548-8104

**Canadian Semiconductor Design Association (CSDA)**
Alan Aitken, President
Canadian Semiconductor Design Association
340 March Road
Suite 400
Kanata, Ontario
K2K 2E1
Tel.: (613) 592-1470
Fax: (613) 592-8163

**La Société de Microélectronique Industriel de Sherbrooke**
Alain Boucher, General Manager
SMIS Inc.
2500 University Blvd
Sherbrooke, Quebec
J1K 2R1
Tel.: (819) 821-7620
Fax: (819) 821-7627

**Solid State Optoelectronics Consortium of Canada (SSOC)**
340 March Road
Suite 400
Kanata, Ontario
K2K 2E4
Tel.: (613) 993-1506
Fax: (613) 957-8734

**Strategic Microelectronics Consortium (SMC)**
Dr. John Roberts, President & CEO
300 March Road
Suite 500
Kanata, Ontario
K2K 2E2
Tel.: (613) 592-8155
Fax: (613) 592-2093