



TT electronics

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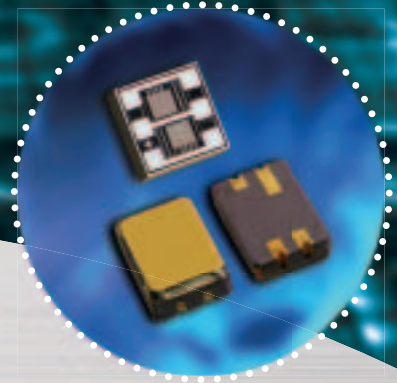
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Company registration No. 87249



High-Reliability Products for Defense/Aerospace Electronics



Leading in Tomorrow's Technology



Satellite and Space Systems

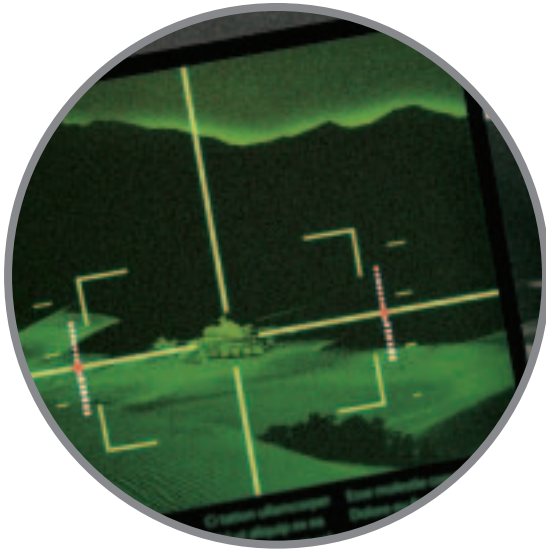
Military Avionics

Commercial Aviation

Aerospace and Missile Guidance

Weapons Systems

Delivering high-reliability technology on target for defense and aerospace applications



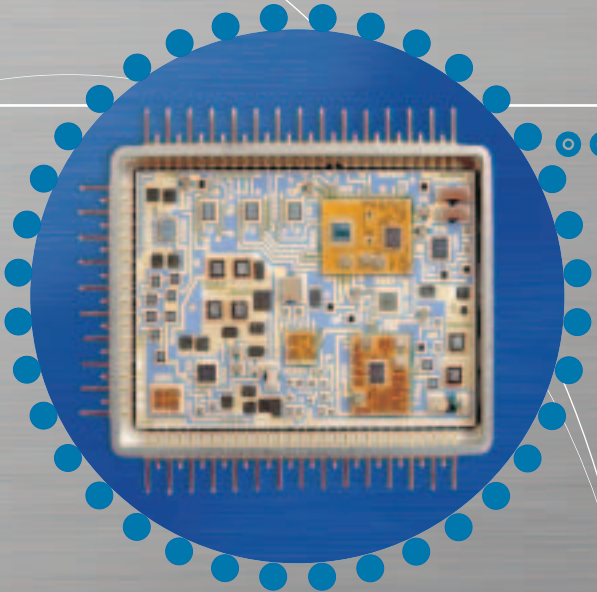
TT electronics is a global supplier of advanced electronic technologies for military, aerospace and other high-reliability systems manufacturers. Through its divisions, TT electronics provides one of the industry's most comprehensive ranges of advanced application specific products, applications engineering experience, and world-class manufacturing facilities that meet the stringent requirements of military certifications.

Throughout the world, TT electronics is a major supplier to military electronics equipment manufacturers, government agencies, commercial aviation and aerospace contractors, as well as independent design firms engaged in high-reliability military and defense systems design. Individual divisions specialize in standard and custom microelectronic assemblies, Hall and effect optoelectronic sensors, resistors, resistor networks and precision potentiometers. As a combined company, TT electronics can serve as a single-vendor source for this wide range of military, space, high-reliability and COTS-level standard products as well as specialized technologies needed to develop innovative custom solutions for the most demanding applications.

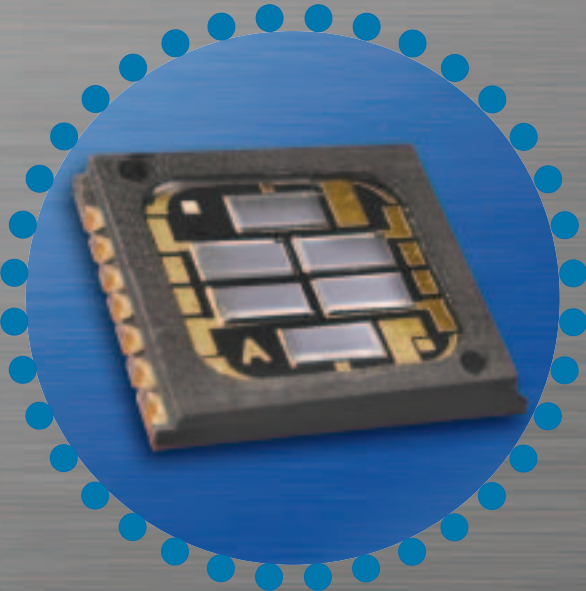
TT ELECTRONICS TECHNOLOGIES

- **Microelectronic assemblies/hybrid microcircuits**
- **Sensors (optoelectronics, Hall-effect, and others)**
- **Resistor networks**
- **Discrete resistors**
- **Potentiometers**

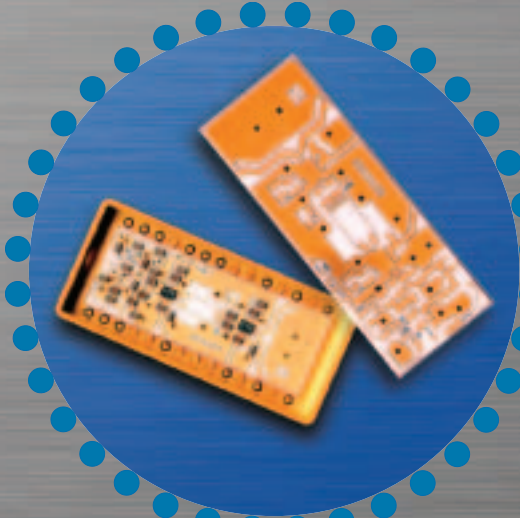
Please turn to the inside back cover of this brochure for manufacturing division contact information.



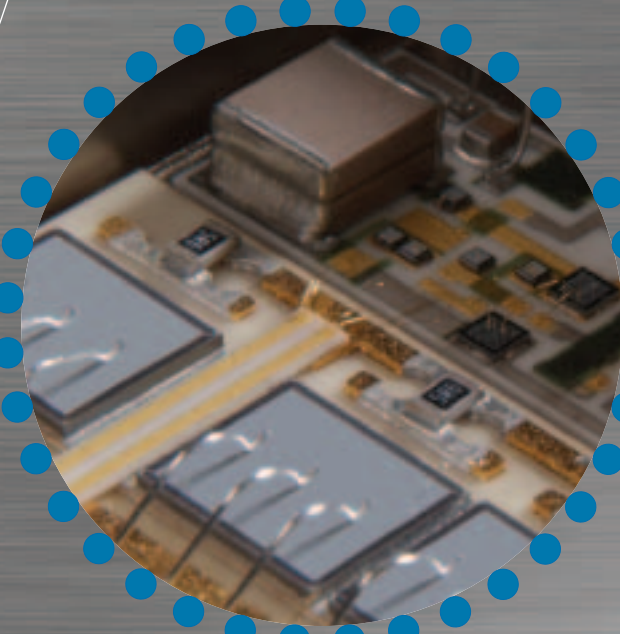
Chip & Wire
Microelectronic
Assemblies



Optoelectronic Assemblies

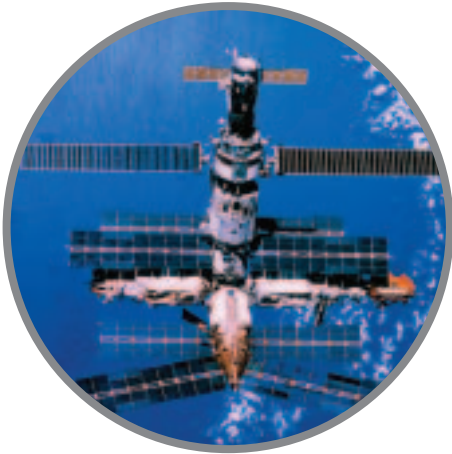


Thin Film
High-Frequency
Substrates



Power Modules

Microelectronic assemblies offer superior reliability



TT electronics' microelectronics assemblies are custom circuits designed to perform a wide range of digital and analog control functions in military and aerospace applications. They offer superior reliability and weight savings over larger circuit boards, and are less costly to design than custom ICs.

From basic miniaturized circuits to complex multi-function packages, TT utilizes substrate, interconnect and packaging technologies. These bring reduced footprints, improvements in thermal management, durability, and electrical and noise performance over competing discrete component systems.

Product highlights

- Hermetic chip & wire microelectronic assemblies
- Encapsulated chip & wire microelectronic assemblies
- Power modules
- Power factor correction modules
- Optoelectronic assemblies
- Thick and thin-film substrates
- Patchwork® technology for integration of power & control on ceramic and steel substrates

Qualifications/ certifications

- MIL-15XXX
- MIL-PRF-38534
- MIL-STD-883
- TX, TXV, B, S, and ESA level
- BS9450 capability approval
- MUHAG (military hybrids)
- EN60065
- CECC Approval
- UL 1412 (product specific)
- TS16949

For detailed product data or application notes, please visit company web sites located on page 11.

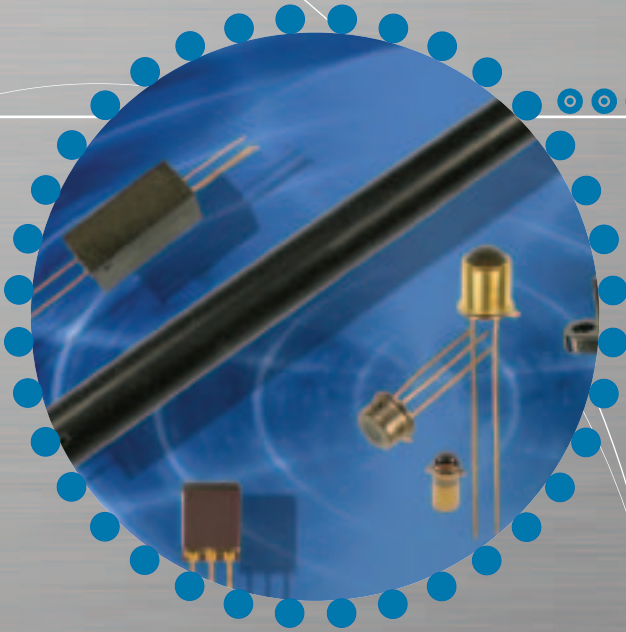
Technical capabilities

- Conductive systems include Au, Ag, PdAg, thick film copper (TFC®)
- Comprehensive range of resistor inks
- Clean rooms to 10,000 ppm
- Ceramic, beryllia, aluminum and steel substrates in a range of thicknesses
- Passive & active laser trimming
- Photo defined thick films with geometries down to 1 mil
- Die attach (conductive/non-conductive epoxy, eutectic, solder)
- Hermetic and local encapsulation
- Ultrasonic wirebonding up to 20 mils diameter
- Multi-site manufacturing - USA, Europe, Mexico, Malaysia, Barbados, China
- Lead-free capability
- Extended temperature operation (-55°C to +150°C)

APPLICATIONS IN ACTION

TT electronics engineers were approached by a major aerospace customer to replace the functions of several older hybrids for aircraft inertial guidance systems. A new design combined the various hybrids into a single microelectronic assembly with less board space and the ability to integrate increased functionality into the system.

Optoelectronics



Optocouplers / Optoisolators



Hall-Effect Sensors



Fiber Optics

Custom Sensors

Advanced sensor technology for military and aerospace



TT electronics provides a wide range of sensor technologies uniquely suited to the rigorous requirements of military and aerospace applications, including optoelectronic sensors, Hall-effect non-contact position sensors, and contacting potentiometric sensors. With the assistance of TT electronics design engineering teams, these technologies have the capability to be engineered to the high-reliability performance standards demanded by customer specifications while surviving the harshest environmental, temperature and mechanical stresses.

Product highlights

- Infrared LED and VCSEL optosensors and assemblies
- Surface mount optocouplers/optoisolators
- Hall-effect sensors and assemblies-- SMT and through hole with accuracy to .025% linearity
- Fiber optic components and transceivers
- LED and sensor "pill packs"
- Precision potentiometric sensors
- Linear position sensors
- RTD sensors

Technical capabilities

- Infrared LED and VCSEL, 850nm to 940nm wavelengths
- Silicon and III-V design capability
- Reflective and interruptor optical sensor designs
- Hall-effect magnetic sensing (bipolar & magnetoresistive)
- Comprehensive in-house group testing
- 100% parametric test capabilities

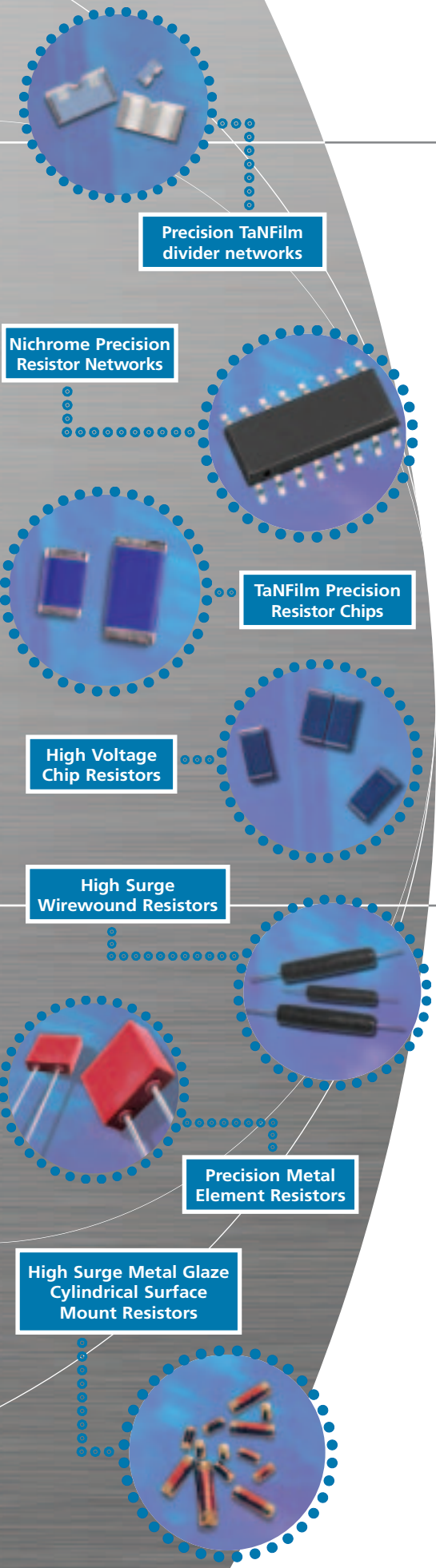
Qualifications/ certifications

- 100% in-house screening and QCI testing (Group A, B, C, D) per MIL-PRF 19500 method of MIL-STD-750 and MIL-STD-883, method 5005
- TX, TXV, B, S, and ESA-level process capabilities
- BS EN ISO 9001:2000 certification
- TS16949
- TSAT

APPLICATIONS IN ACTION

A major aerospace contractor needed a radiation-tolerant sensor to replace microswitches in a Class S program related to the International Space Station. TT electronics engineers developed a high-reliability Hall-effect magnetic position sensor designed to operate in the harsh environments of deep space. This technology is now used extensively in satellite and space applications.

Precision resistor networks in a range of



TT electronics offers the industry's most comprehensive range of precision resistive element technologies for networked resistor applications. Ultra-reliable TaNFilm® and precision Nichrome resistive elements are available on ceramic or silicon substrates in a wide variety of approved surface mount, leaded or ball grid array packages as well as bare silicon die for use in military hybrids.

Product highlights

- Surface mount precision TaNFilm networks on ceramic or silicon
- Leaded precision TaNFilm networks in thermocompression bonded DIP and SIP ceramic packages
- Specialized military "flatpack" precision networks
- High-frequency resistor networks and substrates to 40Ghz
- Surface-mount precision Nichrome networks on ceramic or silicon
- Precision voltage divider chip networks
- Ball grid array (BGA) precision networks
- TaNSil wire bondable resistor networks on silicon die
- Ball grid array (BGA) transmission line terminators

Discrete resistors with proven reliability

With one of the industry's most extensive range of high-reliability discrete resistor technologies, TT electronics can offer virtually any custom or standard rating or form factor needed for military and high-reliability resistor applications. As a major supplier to international defense and aerospace contractors, TT electronics has been at the forefront of developing new products to meet the most demanding customer requirements.

Product highlights

- Surface mount precision TaNFilm chip resistors
- High-frequency chip resistors and attenuators
- High-reliability precision wirewound leaded resistors
- High surge precision wirewound resistors
- Surface mount cylindrical high power resistors
- High reliability precision metal film leaded resistors in SMT and axial
- Ultra high and ultra low resistance value resistors
- Specialized precision fusing resistors
- Largest variety of current sense resistors in the world
- Planar high voltage solutions
- High reliability power resistors

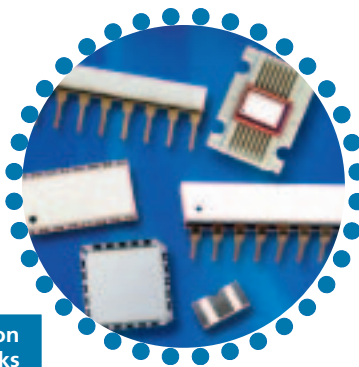
technologies

Technical capabilities

- Resistive tolerances to $\pm 0.02\%$ absolute; $\pm 0.005\%$ ratios
- TCRs to $\pm 10\text{ppm}/^\circ\text{C}$ absolute; $\pm 2\text{ppm}/^\circ\text{C}$ tracking
- Resistance range from 0.5Ω to $2\text{M}\Omega$
- Class 100, 1,000 and 10,000 clean room manufacturing
- Ceramic, silicon and metallized substrates
- Precision films include platinum, tantalum nitride, titanium, aluminum, copper, palladium, nickel, gold, titanium tungsten and nichrome

Qualifications/ certifications

- MIL-PRF-83401
- SSQ100x (International Space Station)
- Multiple DSCC drawings
- Class H QML listed
- MIL-PRF-38354
- MIL-STD-883 screening



TaNFilm Precision Resistor Networks

APPLICATIONS IN ACTION

After experiencing quality problems with its current supplier, a major international defense contractor turned to TT electronics to develop ultra-stable precision resistor networks for cockpit electronic controls. A unique passivation process enabled the networks to meet the contractor's stringent stability requirements even under temperature and humidity extremes, as well as high voltage conditions.

Technical capabilities

- Resistive tolerances to $\pm 0.01\%$
- TCRs from $\pm 2\text{ppm}/^\circ\text{C}$ to $+6000\text{ppm}/^\circ\text{C}$
- Resistance range from 1Ω to $12\text{M}\Omega$
- Power ratings from 0.125W to $>375\text{W}$
- Voltage ratings to $>3\text{kV}$
- Wirewound, metal film or metal element resistor technologies
- Surface mount chips and cylindrical resistors
- Axial and radial leaded resistors
- Comprehensive military testing facilities in-house

Qualifications/ certifications

- MIL-R-93 (RB)
- MIL-R-22684
- MIL-R-49462
- MIL-R-10509
- MIL-R-39005 (RBR)
- MIL-R-39017, S-level
- MIL-R-55182, S-level
- MIL-PRF-38534
- MIL-PRF-55342
- MIL-R-83401
- MIL-15XXX
- MIL-STD-883 screening
- S-level qualification
- CECC

APPLICATIONS IN ACTION

A leading developer of satellite-based scientific instruments required a high voltage resistor for an optical detection system. Vibration, temperature sensitivity and voltage coefficient were all mission critical factors. TT electronics engineers devised a solution together with custom qualification and screening programs to satisfy their extreme reliability demands.

For detailed product data or application notes, please visit company web sites located on page 11.

Precision potentiometers provide reliable position sensing

TT electronics has been a leading industry innovator in developing standard and custom precision potentiometers and trimmers for specific applications within many major weapons systems, aerospace vehicles and military platforms around the world. In many cases, TT electronics applications engineers have taken an existing high-reliability product design and adapted it to meet the demanding requirements of military and aerospace applications.



Precision Potentiometers

Product highlights

- Conductive plastic potentiometers
- Wirewound potentiometers
- Hybrid potentiometers
- Single and multi-turn potentiometers
- Spring return linear potentiometers
- Surface mount cermet trimmers
- Through hole cermet trimmers
- Single and multi-turn trimmers
- Miniature SPDT switches

Qualifications/ certifications

- Built to meet or exceed MIL-PRF-12934 and MIL-PRF-39023
- Space-level qualifications

Custom Precision Potentiometers

Technical capabilities

- Extensive range of models and pin configurations
- Rotational life up to 25 million revolutions
- Linearity to $\pm 0.02\%$
- Operating temperature range: -65°C to $+150^{\circ}\text{C}$
- Miniature sizes down to 3mm case size

APPLICATIONS IN ACTION

A leading defense contractor needed a precision position sensor for a critical circuit in the braking system of its latest military aircraft design. After evaluating linear variable differential transformer (LVDT) non-contacting sensors, they turned to TT electronics for a custom potentiometric linear sensor that employed proprietary conductive plastic materials and an advanced design that met or exceeded all specifications: Long life (5 million actuations); dual independent outputs in a single package; light weight (2 ounces); and superior sealing capability.

For detailed product data or application notes, please visit company web sites located on page 11.

IRC - Advanced Film Division

Company Profile

IRC-AFD is a state of the art manufacturer of a variety of resistive products utilizing thin and thick film technologies.

IRC-AFD offers tantalum nitride chip resistors and networks manufactured on ceramic or silicon substrates. This technology provides the industry with the only self-passivating resistors, impervious to moisture contamination. The thin film networks are offered in standard JEDEC or BGA packages. IRC-AFD also offers thin film platinum temperature sensors used where temperature compensation is critical. High frequency thin film products are also available in various packages.

IRC-AFD is certified to ISO9001 and QS9000.

Product Range

- SMT Precision Chips and Networks
- SMT Current Sense Chip Resistors
- SMT Voltage Dividers
- SMT Military Chips
- Leaded Precision Networks
- SMT Resistor-Capacitor Networks
- SMT Temperature Sensors
- SMT Wire-bondable chips and networks
- SMT Igniters
- SMT Low Pass Filters
- Hybrid Substrates
- SMT Ball Grid Arrays

Contact Details

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Fax: +361-992-3377
Email: ircafd@irctt.com

www.irctt.com

IRC - Wire and Film Technologies Division

Company Profile

IRC-WAFT offers a wide range of wirewound and metal film components as well as an advanced thick film on steel technology line of products. Its resistive offering is available in many market-driven formats and packages including surface mount, axial, radial and custom packages. IRC-WAFT also offers metal glaze, metal film, metal oxide and thick film technology resistors in a wide variety of tolerances, power and voltage ratings.

IRC-WAFTs new products include innovative resistor module solutions, surface mount technology and thick film integration with steel.

IRC-WAFT is certified to ISO9001 and QS9000.

Product Range

- Complete family of leaded wirewound products
- Complete family of leaded metal film products
- Many custom resistive options are available
- Full complement of surface mountable film and wirewound products
- Custom thick film on steel technology products

Contact Details

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Welwyn Components

Company Profile

Welwyn provides leading edge technology in resistive components and custom microelectronic assemblies for a broad range of applications.

Welwyn offers local production combined with application, engineering design and technical sales assistance to help identify technology synergy and provide time-to-market solutions for your designs.

A skilled workforce and a significant investment in high volume automated production has created partnerships with major customers that position Welwyn as the market leader in Europe.

Welwyn is certified to ISO9001: 2000 & TS16949 Comprehensive range of CECC approved resistor products available.

Product Range

- Thick film substrates and microelectronic assemblies
- Integration of power and control circuits for industrial applications
- Photo image circuits on ceramic for high-density/high-frequency applications
- Chip and wire assemblies in hermetically sealed packages
- Thick film resistors in surface mount technology
- Thin film axial resistor technology
- Wirewound resistors for power handling applications
- Precision resistors for instrumentation and medical

Contact Details

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OPTEK Technology

Company Profile

OPTEK Technology is a leading supplier of optoelectronics and sensing technology, providing products for the office equipment, industrial, medical, automotive, hi-reliability and data communications industries. Custom designs and innovative solutions are OPTEK's core competencies.

OPTEK is certified to ISO9000 and ISO/TS 16949 (QS9000); ITAR and ESA-level processing available.

Product Range

- Optoelectronic components: LED, VCSEL, photodiodes, phototransistors, photologic
- Optoelectronic switches: slotted and reflective
- Fiber optic components: LED, VCSEL, photodiodes, receivers, transceivers
- Magnetic components: hall-effect, uni-polar, bi-polar, magneto-resistive
- Visible LED products

Contact Details

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www.optekinc.com

TT electronics

TT electronics plc is a focused, global electronics company supplying the world's leading manufacturers in the aerospace and defense market. TT's continuing investment in modern manufacturing equipment and the development of new technologies is based upon understanding our customers' needs and providing solutions.



BI Technologies - ECD

Company Profile

BI Technologies has been an innovator and leader in electronic components for more than 50 years, manufacturing products for communication, computer, industrial and automotive applications.

BI Technologies serves a global customer base with manufacturing locations in the United States, Mexico, Scotland, Japan, China and Malaysia.

Product Range

- Trimming and precision potentiometers
- Position sensors
- Chip resistor arrays
- Resistor networks
- BGA packages
- Integrated passive networks
- Inductors
- Transformers
- Turns counting dials
- Hybrid microelectronics and custom integration products

Contact Details

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